THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIX. No. 1514.] LONDON, MAY 17, 1892. [44TH YEAR. PRICE 6d.

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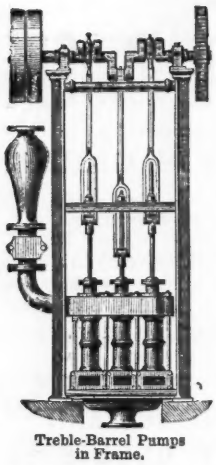
FOR PUMPING TAR, WATER, AND LIQUOR.



Treble-Barrel Pumps in Frame.

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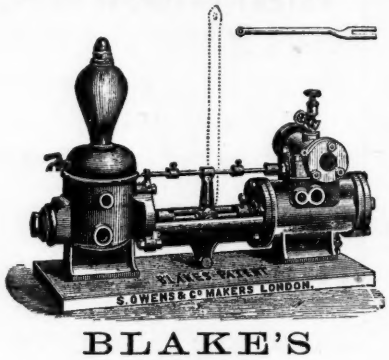

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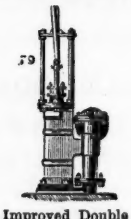
20,000 IN USE.



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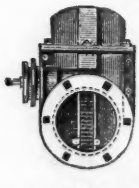

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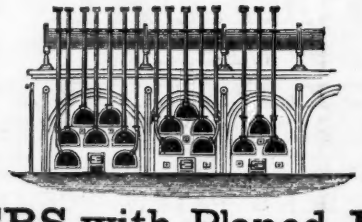

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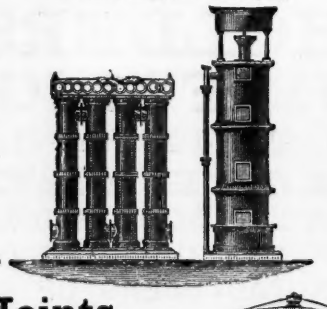

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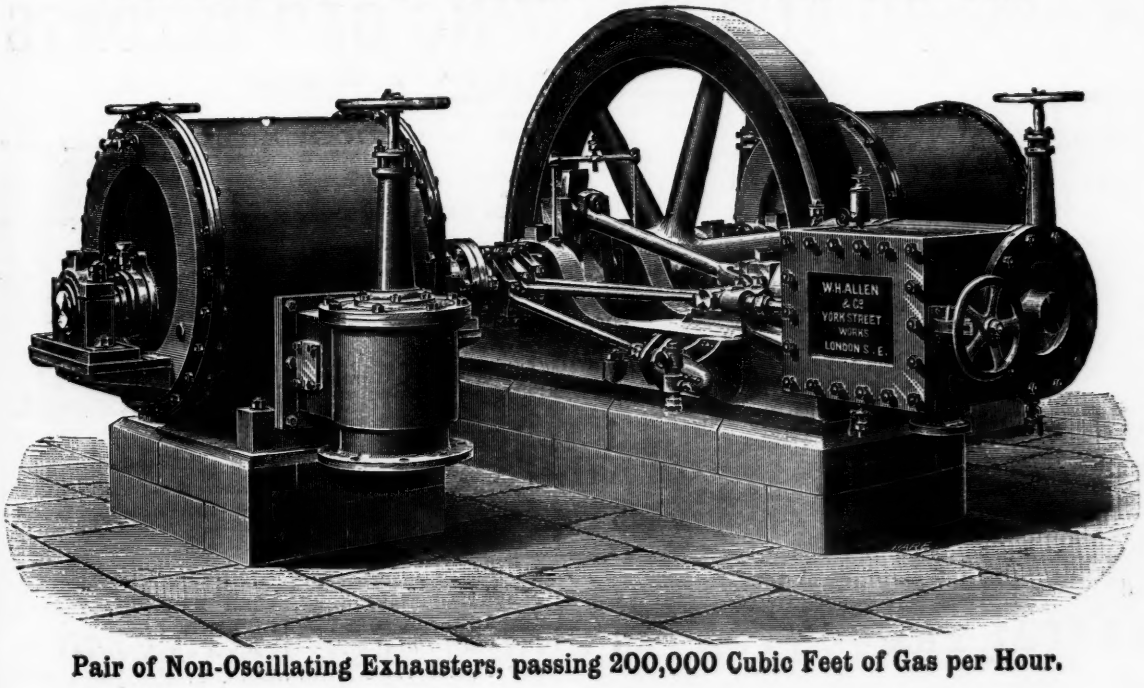
GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.



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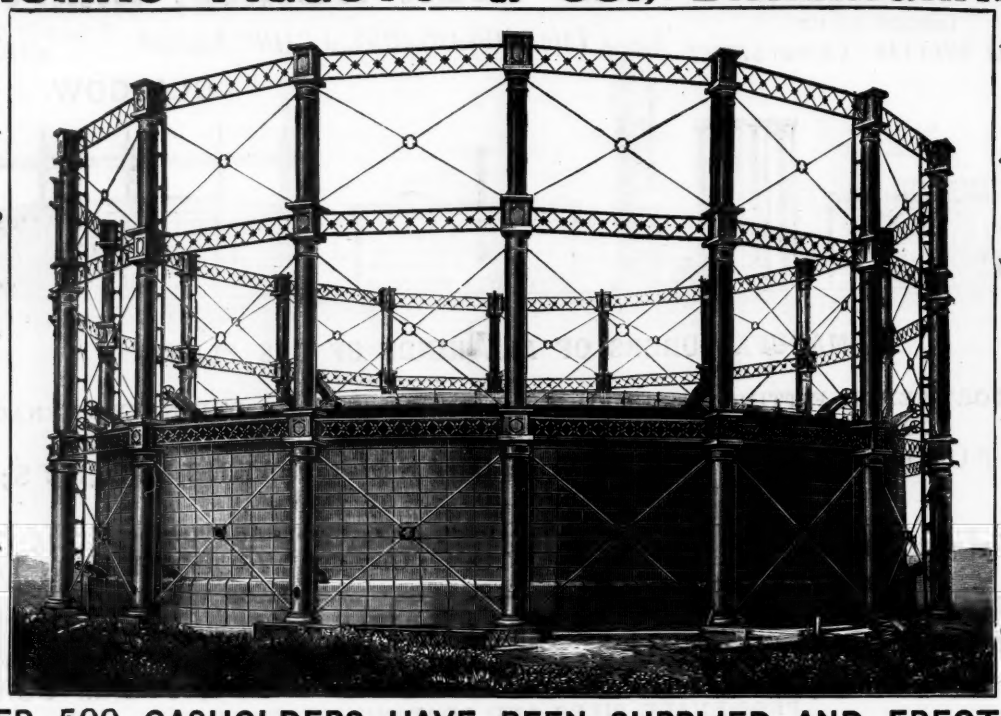

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ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,

MANUFACTURERS OF

WEST'S PATENTED MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS

OVER **180** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

Advantages attending its use are:

INCREASED VOLUME of GAS per TON, and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by COMPRESSED AIR, STEAM, or ROPE. The power machines are applicable to circular, oval, or ⌂-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made. They are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.

MAKERS OF COAL BREAKING, ELEVATING, AND CONVEYING MACHINERY, COKE BREAKING AND WASHING MACHINERY.

Sole Makers of **CIRCULAR, OVAL, or ⌂-shaped MOUTHPIECES** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

secure a very tight joint; and at the same time the eccentric motion given to the Lid effectually removes the Tar from the surfaces of the Joint.

N.B.—The whole of these Fittings are made of Wrought Iron. Several Thousands in use.

West's Improved Combined Regulating Liquor Seal Valve.

OXIDE ELEVATING MACHINERY, COKE BARROWS, VALVES, AND ALL GAS-WORKS PLANT, &c.

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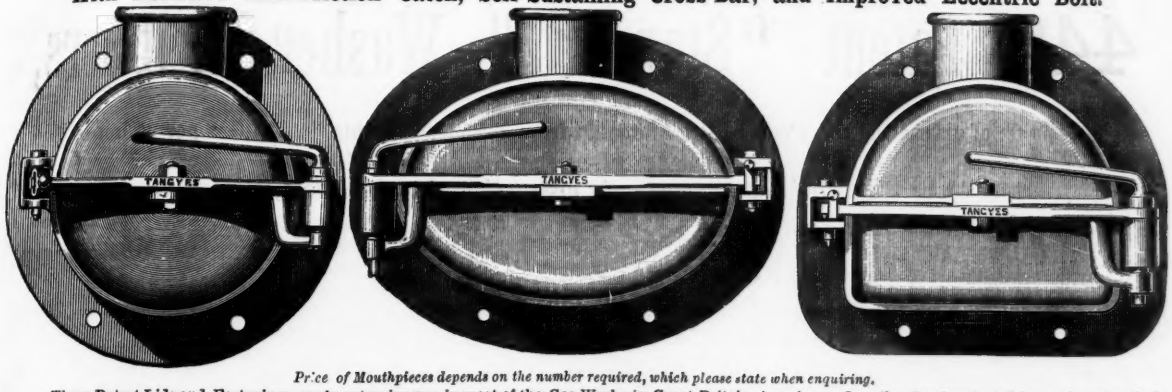
MORTON'S SELF-SEALING RETORT-LID

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



Price of Mouthpieces depends on the number required, which please state when enquiring.

These Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, round, oval, and D (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
3494	14 ins.	14 ins.	12½ ins.	£0 19 0
2982	15 ,,	15 ,,	14 ,,	1 0 0
3453	15 ,,	15 ,,	12½ ,,	1 0 0
3497	15 ,,	15 ,,	15 ,,	1 0 0
3630	16 ,,	16 ,,	10½ or 11⅝ ,,	1 1 0
4549	16 ,,	16 ,,	15½ ,,	1 1 0
6262	16 ,,	16 ,,	13½ ,,	1 1 0
6396	16 ,,	16 ,,	15 ,,	1 1 0
7668	16 ,,	16 ,,	17⅝ ,,	1 1 0
10289	16 ,,	16 ,,	11 ,,	1 1 0
3356	17 ,,	17 ,,	15 ,,	1 3 0
7125	17 ,,	17 ,,	6 ,,	1 3 0
933	18 ,,	18 ,,	11⅝ ,,	1 5 0
4045	18 ,,	18 ,,	14 ,,	1 5 0
6397	18 ,,	18	15 ,,	1 5 0
8013	18 ,,	18 ,,	15 ,,	1 5 0

Taper Circular Mouthpieces with Circular Lids for Round Retorts.

	Front.	Back.			
13001	15 to 21 ins.		21 ins. diam.	13½ ins.	£1 0 0
13261	15 ,, 24 ,,		15 ,,	13½ ,,	1 0 0
12995	15 ,, 30 ,,		30 ,,	13 ,,	1 0 0
9562	18 ,, 21 ,,		21 ,,	12½ ,,	1 5 0
10425	18 ,, 21 ,,		21 ,,	4½ ,,	1 5 0
13418	18 ,, 23 ,,		22 ,,	12 ,,	1 5 0
13396	20 ,, 20⅝ ,,		20⅝ ,,	4 ,,	1 11 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 18 ins.	7 ins.	£0 19 0
14209	14 ,,	14 ,, 18 ,,	13½ ,,	0 19 0
14231	14 ,,	12⅝ ,, 12⅝ ,,	10 ,,	0 19 0
3463	15 ,,	15 ,, 18 ,,	14 ,,	1 0 0
6678	15 ,,	15 ,, 14 ,,	12 ,,	1 0 0
3661	15½ ,,	15½ ,, 18 ,,	12 ,,	1 1 0
13052	16 ,,	16 ,, 18 ,,	18 ,,	1 1 0
5601	16 ,,	16 ,, 14 ,,	15 ,,	1 1 0
6827	16 ,,	16 ,, 14 ,,	17 ,,	1 1 0
4494	16 ,,	16 ,, 14 ,,	14 ,,	1 1 0
3548	16 ,,	16 ,, 15 ,,	12⅝ ,,	1 1 0
6677	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
9645	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
4434	16 ,,	17½ ,, 14 ,,	14 ,,	1 1 0
6469	16 ,,	18 ,, 14 ,,	15 ,,	1 1 0
9015	16 ,,	18 ,, 14 ,,	18½ ,,	1 1 0
4327	16 ,,	18 ,, 15 ,,	15½ or 19 ,,	1 1 0
8049A	16 ,,	18 ,, 15 ,,	17⅝ ,,	1 1 0
6137	16 ,,	20½ ,, 13½ ,,	13½ ,,	1 1 0
5918	17 ,,	18 ,, 14 ,,	14 or 17 ,,	1 3 0
5053	17 ,,	19⅝ ,, 12 ,,	14⅛ ,,	1 3 0
7548	17 ,,	20 ,, 13 ,,	15 ,,	1 3 0
6468	17 ,,	20 ,, 16 ,,	15½ ,,	1 3 0
4316B	17 ,,	21 ,, 14 ,,	14 ,,	1 3 0
7975	17 ,,	21 ,, 15 ,,	14½ ,,	1 3 0
13459	17 ,,	21½ ,, 13½ ,,	15 ,,	1 3 0
14284	18 ,,	18 ,, 13½ ,,	19 ,,	1 5 0
12990	18 ,,	18 ,, 15 ,,	15 or 19 ,,	1 5 0
7135	18 ,,	18⅝ ,, 15 ,,	13 ,,	1 5 0
10221	18 ,,	18 ,, 16 ,,	12⅝ ,,	1 5 0
4506	18 ,,	20 ,, 13 ,,	19½ ,,	1 5 0
6475	18 ,,	20 ,, 13 ,,	15 ,,	1 5 0
6818	18 ,,	20 ,, 13½ ,,	17½ ,,	1 5 0
13998	18 ,,	20 ,, 14 ,,	19½ ,,	1 5 0
4083	18 ,,	20 ,, 15 ,,	16 ,,	1 5 0
5306	18 ,,	20½ ,, 14 ,,	13½ ,,	1 5 0
13295	18 ,,	20½ ,, 14 ,,	19½ ,,	1 5 0
7856	18 ,,	20½ ,, 13½ ,,	13 ,,	1 5 0
4569	18 ,,	21 ,, 14 ,,	18 ,,	1 5 0
3628	18 ,,	21 ,, 15 ,,	16 ,,	1 5 0
13999	18 ,,	22 ,, 14 ,,	19½ ,,	1 5 0
7640	18 ,,	22 ,, 12½ ,,	13½ ,,	1 5 0
14250	19 ,,	19 ,, 14 ,,	19 ,,	1 8 6
14286	19 ,,	20 ,, 13½ ,,	20 ,,	1 8 6
7971A	20 ,,	20 ,, 15 ,,	18 ,,	1 11 0
14285	20 ,,	21 ,, 13½ ,,	19 ,,	1 11 0

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 ,,	18½ ,, 12 ,,	12⅝ ,,	0 19 0
6851	15 ,,	16 ,, 14 ,,	13 ,,	1 0 0
3629	15 ,,	18½ ,, 13½ ,,	14 ,,	1 0 0
3580	15 ,,	21 ,, 15 ,,	15 ,,	1 0 0
6264	16 ,,	18½ ,, 15½ ,,	15⅜ ,,	1 1 0
5210	16 ,,	20 ,, 14 ,,	15 ,,	1 1 0
6263	16 ,,	24 ,, 16 ,,	13½ ,,	1 1 0
5370	17 ,,	20 ,, 14 ,,	14 ,,	1 3 0
6832	17 ,,	20 ,, 14 ,,	17 ,,	1 3 0
6183	17 ,,	20 ,, 15 ,,	15 ,,	1 3 0
4289	17 ,,	21 ,, 15 ,,	14 ,,	1 3 0
5270	17 ,,	22 ,, 14 ,,	14 ,,	1 3 0
3631	18 ,,	18 ,, 14 ,,	20 ,,	1 5 0
3681	18 ,,	21 ,, 14 ,,	13½ or 15 ,,	1 5 0
3554	18 ,,	21 ,, 15 ,,	14⅜ ,,	1 5 0
7957	18 ,,	22 ,, 16 ,,	14 ,,	1 5 0
8048A	19 ,,	25½ ,, 15 ,,	18 ,,	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
9800	18 × 14⅞ ins.	18 × 14⅞ ins.	15 ins.	£1 5 0
9205	20 ,, 12 ,,	24 ,, 14 ,,	10¼ ,,	1 10 0
10000	20¼ ,, 14¼ ,,	20¼ ,, 14¼ ,,	16 ,,	1 10 0
9680	21 ,, 15 ,,	21 ,, 15 ,,	15 ,,	1 12 0
10056	21 ,, 14½ ,,	21 ,, 14½ ,,	15¾ ,,	1 12 0
13218	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 12 0
10514	22⅛ ,, 13⅜ ,,	22⅛ ,, 13⅜ ,,	13⅜ ,,	1 13 0
13766	20 ,, 17 ,,	20 ,, 17 ,,	15⅛ ,,	1 15 0
13269	24 ,, 15 ,,	24 ,, 15 ,,	16 ,,	1 18 0
13884	24 ,, 15 ,,	24 ,, 15 ,,	10 ,,	1 18 0

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	13 ins.	£1 2 0
9967	16 ,, 14 ,,	16 ,, 14 ,,	15½ ,,	1 3 0
13574	16⅜ ,, 13⅜ ,,	16⅜ ,, 13⅜ ,,	12½ ,,	1 4 0
9899	18 ,, 12 ,,	18 ,, 12 ,,	14 ,,	1 4 0
13080	16 ,, 16 ,,	16 ,, 16 ,,	18 ,,	1 6 0
13900	18 ,, 13½ ,,	18 ,, 13 ,,	15 ,,	1 6 0
9912	18 ,, 13½ ,,	18 ,, 13½ ,,	17 ,,	1 6 0
9962	18 ,, 13½ ,,	18 ,, 13½ ,,	16 ,,	1 6 0
10982	18 ,, 13½ ,,	18 ,, 14 ,,	15 ,,	1 6 0
11098	18 ,, 14 ,,	18 ,, 14 ,,	12 ,,	1 6 0
9492	20 ,, 13 ,,	20 ,, 13 ,,	15 ,,	1 10 0
9208	20 ,, 13 ,,	20 ,, 13 ,,	19½ ,,	1 10 0
10251	20 ,, 13 ,,	20 ,, 13 ,,	15⅝ ,,	1 10 0
12964	20 ,, 13 ,,	20 ,, 13 ,,	13⅝ ,,	1 10 0
9909	20 ,, 13½ ,,	20 ,, 13½ ,,	17 ,,	1 10 0
12969	19½ ,, 15½ ,,	19½ ,, 15½ ,,	14 ,,	1 11 0
13781	20 ,, 15 ,, Front. / 21 ,, 15 ,, Back.	21 ,, 15 ,,	15 ,,	1 11 0
14287	20½ ,, 14⅞ ,,	20½ ,, 4⅞ ,,	17 ,,	1 11 0
7692	21 ,, 15½ ,,	21 ,, 15½ ,,	16 ,,	1 11 0
12978	20 ,, 16 ,,	20 ,, 16 ,,	17 ,,	1 11 0
13252	20 ,, 16 ,,	20 ,, 16 ,,	18 ,,	1 11 0
13220	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 11 0
13992	21 ,, 16 ,,	21 ,, 16 ,,	17 ,,	1 11 0
8977	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
8976	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
10497	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
8037	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
9908	21½ ,, 13½ ,,	21½ ,, 13½ ,,	15 ,,	1 12 0
10404	21½ ,, 13⅜ ,,	22 ,, 14 ,,	18⅜ ,,	1 12 0
12410	21½ ,, 13⅜ ,,	22 ,, 14 ,,	12 ,,	1 12 0
13822	21½ ,, 13⅜ ,,	22 ,, 14 ,,	15 ,,	1 12 0
10515	22½ ,, 12⅜ ,,	22½ ,, 12⅜ ,,	13½ ,,	1 12 0
7924	24 ,, 14 ,,	24 ,, 14 ,,	15⅜ ,,	1 13 0
13807	24 ,, 15½ ,,	24 ,, 15½ ,,	16 ,,	1 14 0
9015B	25 ,, 14 ,,	25 ,, 14 ,,	12½ ,,	1 14 0
10932	25 ,, 14 ,,	24 ,, 14 ,,	13½ ,,	1 15 0
12944B	22 ,, 16 ,,	22 ,, 16 ,,	16 ,,	1 15 0
14037	22 ,, 16 ,,	2 ,, 16 ,,	16 ,,	1 15 0
14119	22 ,, 16 ,,	22 ,, 16 ,,	18 ,,	1 15 0

Patterns marked A have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.

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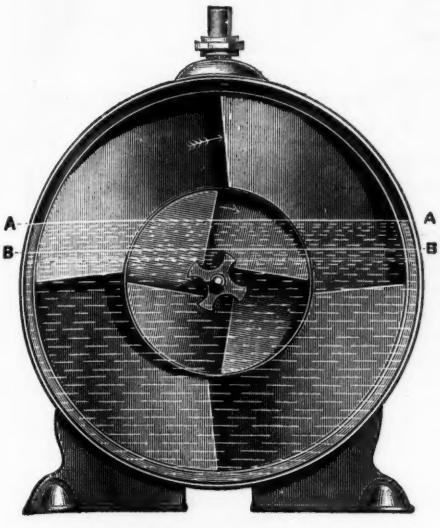
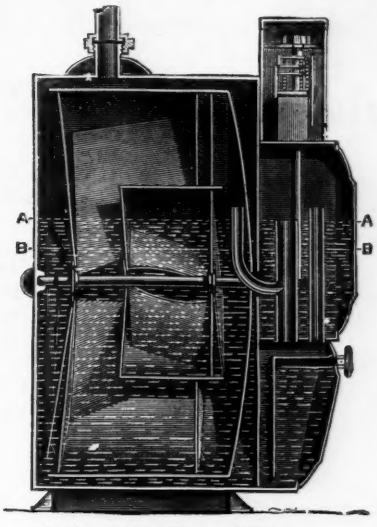
THE WARNER AND COWAN METER.



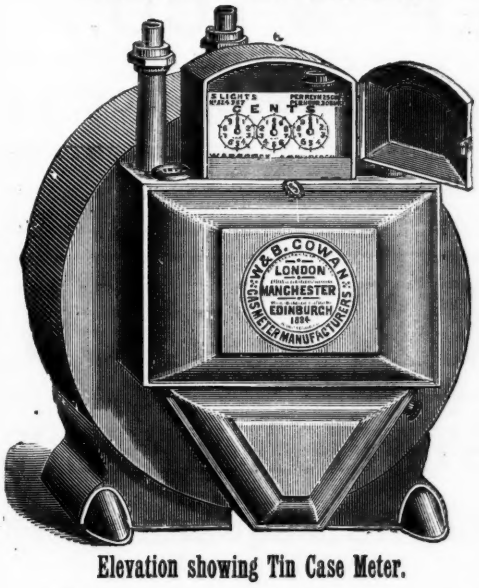
A A, High-Water Line.

B B, Low-Water Line.

Drum in Case. Hollow Cover removed.



Sectional Side View of Meter.



Elevation showing Tin Case Meter.

Elevation showing Cast-Iron Case Meter.

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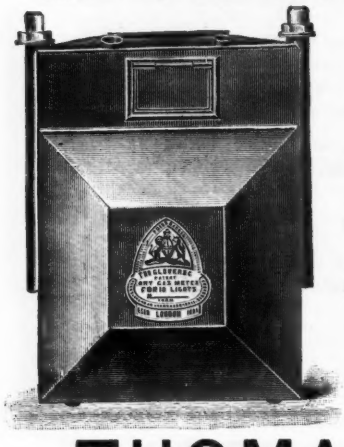

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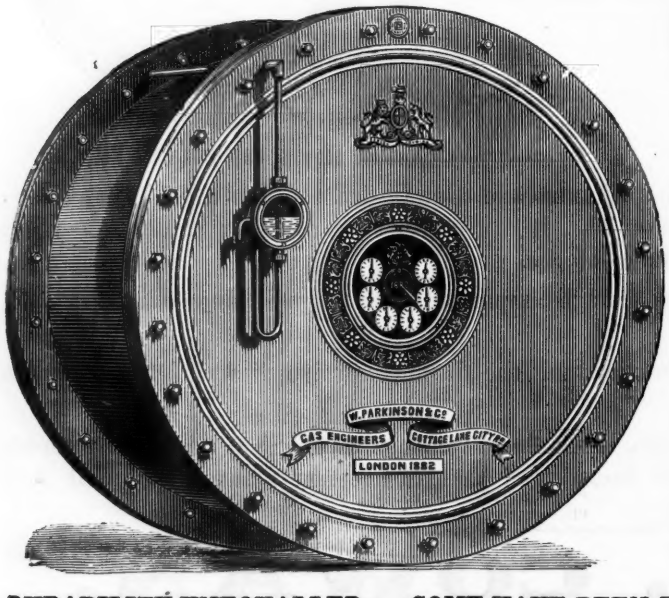

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[See also Advt., p. 940.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 17, 1892.

The Institution Meeting.

THE members of the Incorporated Institution of Gas Engineers met on Wednesday and Thursday last, under the presidency of Mr. Charles Hunt, of Birmingham; and the gathering is fully deserving of first mention as the event of the week in the annals of the British gas industry. The meeting was completely successful in every way. It was well attended; and the varied items of a time-table which was almost too well filled, were all followed up with a zeal which only just fell short of enthusiasm. It is not possible to doubt now that the Institution does fill a real want. It brings together men from whom their professional colleagues are at all times ready to hear, and who are apparently not to be reached in any other way. And its papers are truly authoritative, in the sense that they emanate from most competent sources of information. The meetings of the Institution are pervaded by the most severely practical spirit. The authors of the papers give one the impression that their chief desire is to air their subjects rather than themselves; and the same candid sinking of the personal in the material characterizes the discussions. The two first Presidents of the Institution have set their followers a bright example of strict attention to business; and to them and to the Council must be ascribed the gratifying result that the meetings of the Institution are already taking rank with gatherings where something is to be learnt.

This year the meeting, by accident or design, or by a combination of both, was largely devoted to threshing out the questions of oil gas and carburetted water gas, as these affect British gas undertakings. The result was really good; for whether the various authors of papers and the speakers agreed or differed, the effect was to throw a strong light upon the subjects under notice. This class of gas engineering topics is quite a novelty in British gas managers' meetings; and it is possible to sympathize with the perplexity of those who discovered a difficulty, after perusal of the programme, in deciding whether the "gas" mentioned in the title of the Institution should be understood to be coal, oil, or water gas. It is idle to protest, however, that the trade of the members of the Institution is the manufacture of coal gas, and of this alone. For it is a general truth that hitherto the coal-gas works of all parts of the United Kingdom have depended upon more than one class of raw material. A store of cannel has always occupied a more or less prominent place in every works, even where the output of gas has not been of particularly high quality, judged merely from its illuminating power. Scotch gas makers, as is known, have been great sticklers for using only the best class of cannel, and have even gone so far as to stigmatize as "dross" the coal with which their southern brethren have to deal. But whether they used much or little of it, cannel has always been the gas managers' "friend "in need." Now, however, this friend is failing them on all hands. District after district from which cannel coal has been drawn during the last hundred years, is being worked out; and the owners of the yet available pits are stiffening their terms accordingly. Thus, therefore, the gas manager has no choice in the matter. Whether he will or no, he must think more about oil than he used to do; and the Institution has laid itself out to present in one view the actual state of knowledge of the various ways in which oil may be employed for the purposes of British gas makers.

If it did no more than this, the recent meeting would have deserved to be called successful in the technical sense; but the attention of the members was not confined to oil. They had the opportunity of hearing about, and of talking over, other matters of contemporary interest; and their trip to East Greenwich must have been deeply instructive to most of them. For whatever can or can not be said of Mr. George Livesey and his brother and their aids, they are at least progressive. They are men of ideas, with whom it is good to confer. They make every completed work a stepping-stone to something still better; and and they would regard an achievement in construction as almost a failure if it did not suggest an improvement upon itself. Conversely, when viewed in this light, a failure that illustrates the way to better things is never a total loss. This is the real secret of progress in gas engineering as in other things; and it is the possession of this power in such an eminent degree that renders the works of the Liveseys so irresistibly attractive in the eyes of their professional colleagues. Moreover, nobody—not even himself—can ever say what Mr. Livesey will do next; and so to his other interesting qualities he adds that of surprising on-lookers, which is sure to rivet attention.

There is no sound at present of the Institution quitting London; nor does there appear any urgent reason why the locality of the meetings should be changed. All roads lead to London; and if there is in existence a gas manager East, West, North, or South who objects to the spending of a few days in town during May, we have yet to discover him-

It is purely a question of the convenience of the majority; but there is no difficulty in perceiving which way this consideration points. It only remains now to recognize the excellent way in which the Council must have worked to bring the Institution into its existing satisfactory condition. One or two little matters require further looking into, of course; but, on the whole, the arrangements work remarkably well, considering all things. The Institution has good and powerful friends; but nothing can compensate for lack of experience in administration. Great credit is also due to the painstaking Secretary, Mr. T. Cole, Assoc.M.Inst.C.E., who is an efficient officer. It is undeniable that the position and prospects of the Institution have greatly improved from the conditions of this time twelve months; and there is no reason why the improvement should not continue during the year of Mr. Hunt's presidency.

Gas Workers before the Labour Commission.

THE case of the gas workers has at length been reached by the Labour Commission; the evidence of several prominent unionists occupying Mr. Mundella's Section during two days of last week. We commence in another column our special report of these proceedings. The best witness for the cause of Unionism was Mr. William Thorne, the General Secretary of the Gas Workers' Union, who stated his views with a candour and sincerity that gained him respect, as an earnest partisan, even from those who deplore the twist his mind has received from the socialistic demagogues with whom he has been thrown into such close contact. There is no beating about the bush with Thorne. He says what he means, and does not hold one tone in the mass meeting and another before the Commission. We have always admitted him to be a totally dissimilar kind of man to Ward and the others, whose un-English adroitness in suiting their policy to their company has gone so far to bring the name of Trade Unionism into contempt. Ward was examined before the Commission, of course; but he was a very different person in the room at Westminster from the Ward who harangues stokers outside the gates of gas-works. The story of the South Metropolitan strike was opened, from the Union side, by Mr. T. Blackburn, the Secretary of the Greenwich Branch of the Gas Workers' Union, who tried to make out that the real cause of the strike was the application of the men for double pay for Sunday work. He was subsequently led to confess, however, that the Executive of the Union wrote to the Directors, "asking "them if they would kindly remove" the men who had dared to disobey the orders of the Union by signing the Company's profit-sharing agreement; and he also admitted that there was practically no Sunday work under the South Metropolitan Company. It is significant that this representative Union official, who had so much to do with the proceedings that led to the strike, had only been in the employ of the Company for one year; so that the subsequent locking out of men who had been working for the Company all their lives (which Ward affected so deeply to deplore) was through following the hare-brained counsels of the temporary hands. Both Blackburn and Ward tried to persuade the Commission that the South Metropolitan strike was "made with rose-"water," and that the strikers were as lambs beside the brutal police and the still more bloodthirsty new hands. A different aspect was put upon the practical working of Trade Unionism by the evidence of the man Higgins, originally a unionist gas worker (by compulsion) at Salford, and now a stoking-machine tender at East Greenwich, who was so outrageously libelled by Ward. The evidence of the gas workers before the Commission should be read in conjunction with the newspaper reports of the reception, by the Marquis of Salisbury, of the deputation chosen to represent to the Government the feeling of a party of the working classes in favour of a legal Eight-Hours' Day. Mr. Thorne was a member of this deputation; and he told the Premier that the Gas Workers' Union had spent £10,000 upon strikes to secure the eight-hour shift in gas-works; and he asserted that this had been largely lost again through the action of the employers. This statement hardly squares with the evidence on the subject of gas workers' strikes submitted to the Commission; for in not a single case has it been established that a strike has originated for this reason. It would be advantageous if these discrepancies of testimony were removed.

The Gas Supply of Paris.

THE figures relating to the gas supply of Paris which appeared in last week's JOURNAL supply satisfactory evidence of the sustained popularity of gas in the French capital. The output of the Paris Gas Company has increased so largely, that it is now nearly on a par with the exceptional sale which marked the Exhibition year. The growth for the last twelve months reached the high figure of 142 million cubic feet, which, taking all the circumstances into consideration, is a really astonishing result. The proportion of gas consumed in the daytime, and therefore mainly for industrial and domestic purposes, was 26·45 per cent. of the whole. This is ascribable to the intelligent way in which the Directors of the Company have striven of late years to cultivate the popular taste in the matter of cooking and heating stoves. The administration is also entitled to credit for the readiness which they have displayed in facilitating the distribution of gas among the tenement houses of Paris, from which they now draw a very substantial proportion of their revenue. Coal and labour cost the Company rather more last year than they have been accustomed to pay; and the dividend shows the consequence. Fortunately for the Company, they have a capital sale for their coke, the value of which rose with the increased price of coal—thereby differing from the English coal market. The figures which deal with the Company's profits and dividends are as striking as ever. A profit balance of £1,464,000 resulted from the operations of the Company for the past year; and it was distributed in the following manner: A covenanted rate for share dividend, amounting to £448,000, was first deducted; leaving a sum of £1,016,000 equally divisible between the shareholders and the Municipality. Thus the latter get, as their share of the profits, £508,000, in addition to the proceeds of the tax of 2c. per cubic metre of gas sold, amounting to £210,893, and £8000 for rent of the subsoil occupied by the mains, and £42,937 towards the cost of lighting, &c., the public lamps. Thus the Municipality benefit directly from the gas undertaking (which does not belong to the city) to the extent of £774,830, while the proprietors get altogether £956,000, or after the rate of nearly 30 per cent. on their investment. The State charges, it should also be recorded, amount to a burden on the undertaking of £44,685 in the year. All this is rendered possible by the terms of the concession, which maintain the price of gas at 30c. per cubic metre, at which it has now stood for 36 years. Certainly, the high figure does not seem to stop the Company's growth. Yet it is felt in Paris as a grievance, if not as an absolute scandal; and the Municipality are continually being moved to devise some method of reducing it without injury to vested interests, which is a very difficult matter indeed. It was a year or so ago that a basis for a satisfactory rearrangement of the affairs of the Company was in sight, whereby a reduction in price might have been rendered possible at the cost of a prolongation of the concession. But the negotiations fell through, for some reason; and now, although a renewal of the interminable *pourparlers* upon the subject is spoken of, there is no real prospect of anything being done in the matter. It is in order for both the Municipality and the Company to express a desire to come to a better understanding; but while talking thus, both parties keep a firm grip upon the preposterous profits which the short-sighted framers of the Company's concession enable them to share. And so, as there is no making of omelettes, even in France, without breaking eggs, and it is not evident how the price of gas is to be lowered without diminishing the profit on its sale, things remain as they were, year after year.

Gas Profits and Rating in the Manchester District.

THE Manchester City Council have refused to accept the recommendation of their Gas Committee to reduce the price of gas by 3d. per 1000 cubic feet; thus endorsing once more the traditional policy of the aldermen and councillors identified with the spending departments of the Corporation, and denying to the doubly-rated gas consumers the relief which the circumstances of the undertaking fully justify. There is no attempt to disguise the motive of those who have defeated the efforts of the Committee to further popularize the gas supplied from the Corporation works—it is simply and solely the disinclination to cut off an indirect source of revenue which can be made useful in covering up the losses, waste, and financial

blundering of the Corporation. Having finished hotel building, it might have been thought that the Corporation would have shown more willingness to go directly to the ratepayers for the money required for carrying on the city government; but when was a local authority other than impecunious? Mr. Alderman King says that the School Board precepts are high, and the Council have a deal of work in hand; and therefore he cannot agree to relinquish £36,000 a year from the gas profits. Alderman Sir John Harwood points out that coal is dear, and tar falling in value. But these are minor considerations; and it would be something new for the administration of the Manchester Corporation gas undertaking to frame the selling price with sole reference to considerations of internal economy. Far more to the purpose was Sir J. Harwood's reminder that the Corporation are about to spend £100,000 upon an electric lighting installation which could hardly be expected to pay its way for a long time to come; and, of course, it would be the height of impolicy to do anything calculated not only to deprive the electric lighting venture of the support of gas funds, but also to increase the disparity between the cost to the user of the two systems of lighting. These and similar arguments have proved irresistible; and, accordingly, the gas consumers of Manchester, and the ratepayers who desire, in the interests of good administration, to put a stop to the vicious system of bolstering up one corporation department by another, must possess their souls in patience for another election or two. But how strange it would read if the preamble of all Bills for transferring gas undertakings from companies to local authorities were to rehearse the true reason why corporations like that of Manchester desire this class of property: "Whereas it is expedient "that the corporation should have an indirect source of "revenue, whereby the party in power may be to a "corresponding extent independent of the ratepayers." As will be seen from our reports, Bolton, Rochdale, and Wigan agree with Manchester in acting upon the principle that rates paid through gas bills are not felt. Wigan, indeed, "goes better" than its big neighbour; for, in order that the municipal coffers shall not suffer, the Gas Committee actually pay over in relief of rates 25 per cent. more than their net profits—taking the rest out of their brand-new reserve fund, only established last year. At Rochdale, it is true, Alderman Petrie, speaking as Chairman of the Gas Committee, has awakened to the truth that a wrong and foolish thing has been done in the past in "coddling" the rates at the expense of the gas consumers; but municipal consciences in general are apt to be dull when an apparent lowness of rates can be purchased at the price of a piece of injustice which has "use and wont" to excuse it.

Death of Professor James Thomson.—The death, after a brief illness, of Dr. James Thomson, Emeritus Professor of Civil Engineering in Glasgow University, was announced early last week. He was born in 1822 in Belfast, where his father was Professor of Mathematics in the Royal Academical Institution, and subsequently filled a similar position in Glasgow University. The two sons—James and William—passed through all the classes of that institution with considerable distinction. The former chose the profession of a civil engineer; and, on the completion of his apprenticeship with Sir W. Fairbairn, he commenced business on his own account in Belfast. While resident there, he was appointed Engineer to the Water Commissioners; and in 1857 he became Professor of Civil Engineering in Queen's College. In 1872 he was elected to the professorship at Glasgow which he held at his death. His brother William is now Lord Kelvin.

Electric Light Statistics for Massachusetts.—We have received a copy of the seventh annual report of the Board of Gas and Electric Light Commissioners of Massachusetts, embracing statistics for the year ending June 30, 1891. We learn therefrom that there are 131 companies under the Board's supervision; 26 of them supplying gas and electric light, and 58 electric light only. The receipts last year amounted to $2,440,350, and the expenses to $1,735,206; as compared with $1,920,702 and $1,340,815 in 1889-90. The balance in that year was $579,897; whereas last year it was $705,144. The gas companies supplying electric light earned $110,871 in 1889-90, and $143,241 in 1890-91. The net earnings of the electric lighting companies in 1889-90 were $469,016; in 1890-91, they were $561,903. The Edison Electric Illuminating Company of Boston has the largest capital—$1,263,500. The dividends paid ranged from 10 down to 1 per cent. There were five accidents (one fatal) caused by electricity.

WATER AND SANITARY AFFAIRS.

It is somewhat singular that the London County Council, in sending its statement respecting the Metropolitan Water Supply to the Royal Commission, thought fit for the document to take the form of a letter to the Secretary of the Commission, signed by the Parliamentary Agent of the Council. Why this gentleman should appear in the exercise of a function more naturally appertaining to Lord Rosebery or Mr. De la Hooke, is not very clear, especially as the statement is the result of a consultation in which the Chairman, the Medical Officer, and the Engineer, as well as the Parliamentary Agent, were concerned. Perhaps the County Council look upon the Royal Commission as engaged in an inquiry which falls very far short of the Progressive "program." The inquiry is purely scientific, and has nothing whatever to do with the question as to the right parties to possess the water supply. Neither are the Commissioners authorized to extend their inquiry beyond the watersheds of the Thames and the Lea. If they find that sufficient water for a greatly increased population, such as may be calculated upon for a distant period, can be obtained within the watersheds appertaining to London, the inquiry will terminate with that conclusion. So also if it be considered that the supply thus obtainable is insufficient, the Commission will have fulfilled its instructions. But another inquiry will then have to follow, to ascertain the best source of supply. We may infer, from all the reports and manifestoes issued from the County Hall, that the expectation existing in that quarter is a verdict hostile to the present supply. As the Commissioners have to consider the question of quality as well as quantity, there is the hope on the side of the Council that, if the water is sufficient in volume, it will be objected to as impure. In any case, the Council is doubtless looking for a second and further inquiry; and it is then that the grand opportunity will arise for attacking the Water Companies, and seeking to obtain the command of the situation. The present fight is looked upon rather as a kind of preliminary skirmish. But it may prove to be something more; and the Water Companies must not fail to deal thoroughly with the question. Yesterday the Commissioners examined witnesses appearing on behalf of the New River Company. Mr. Francis, the Company's Engineer, gave evidence as to the large additional supply to be obtained from the wells. The water that goes down the Lea in winter could, he said, also be stored, so as to yield 10 million gallons per diem throughout the year to the New River Company, and a like quantity to the East London Company. To-day the case of the latter Company will be gone into.

Some interesting particulars concerning the "Amines" process, invented by Mr. Hugo Wollheim, for the treatment of sewage, appear in a report which has just been issued, descriptive of experiments conducted last summer at Salford, in which this particular system is said to have proved eminently satisfactory. In the JOURNAL for Sept. 24, 1889, we gave an account of the first experimental demonstration of the process, as applied to the sewage of Wimbledon. The system met with the approval of the Wimbledon Local Board; and it has been in operation there down to the present time, with the result, it is alleged, of being an "unqualified and unvarying success as regards both "efficacy and cheapness." It is claimed for this process that, by the action of lime on certain organic bases belonging to the group of "Amines," a highly soluble gas is evolved, which spreads through every part of the liquid treated, and is held in solution with great tenacity. It is said that this gaseous reagent, which is designated "Aminol," has been found antagonistic to the existence and propagation of every species of bacteria occurring in sewage and other similar waters; these creatures being utterly extirpated in a remarkably short space of time. The absence of offensive smell in connection with the process was mentioned in our report of the Wimbledon demonstration. At the same time, the quantity of lime then in use appeared to be startling—being at the rate of 47 grains per gallon of sewage, coupled with 3 grains of herring-brine. At Salford, only 22½ grains of lime were used per gallon of sewage; the herring-brine being 4 grains. The experiment lasted two weeks, during hot and dry weather; the treatment being continuous, and the total quantity of sewage rather more than 84½ million gallons. The cost of the chemicals was ½d. per 1200 gallons of sewage; and

the entire charge, including all items, is calculated at £807 per annum for a million gallons per day. It is accordingly asserted that the entire cost of the process ranges from ½d. to ¾d. per 1000 gallons treated. Dr. Klein's report on the process as tested at Salford shows that the effluent was practically sterile; and Mr. Charles E. Cassal repeats what he has said on a former occasion, "that clari- "fication and the removal of a substantial part of the "organic matter has been satisfactorily effected." Also "that no objection can possibly be taken to the alka- "linity of the effluent." The final decision of the Salford Corporation, as to the adoption of the process or otherwise, has yet to be declared. Mr. Webster's electrical process is also under consideration; having been exhaustively tried in application to the Salford sewage. Continuously working, day and night, this process has yielded, if possible, even better results than when it is only worked intermittently.

Presentation to Mr. W. T. Batten.—An interesting meeting was held at the Singapore Gas-Works on the 12th ult. The men employed on the works, to the number of a hundred, consisting of Chinese, Malays, and Tamils, clad in the picturesque Eastern garments peculiar to their races, assembled in front of the Manager's house, to present a silver tray to Mr. W. T. Batten, on the occasion of his leaving Singapore for England. Mr. H. Willis Smith, the newly-appointed Manager, was asked by the men to present the tray, and also an address printed on white satin and ornamented with bows of ribbon in the Chinese style. This duty he discharged in felicitous terms; concluding by expressing his hearty concurrence with the sentiments contained in the last paragraph of the address, and wishing Mr. and Mrs. Batten long life and prosperity. Mr. Batten feelingly acknowledged the gifts. He congratulated the Company on having obtained good native servants, many of whom had, he said, been with them for 30 years. He assured these old employees, and also those who had joined the Company later, that not only he, but also the Directors had appreciated their services; and he was sure that their interests would be as well looked after in the future by his successor (Mr. Smith) as they had been by himself.

The Glasgow Water-Works Extension.—There are several interesting features in connection with the new service reservoir now in course of construction by the Corporation of Glasgow at Milngavie, forming an important section of the extension scheme devised by Mr. J. M. Gale, M.Inst.C.E., their Water Engineer, which is being rapidly pushed forward. A special point is the depth to which, at one side, it has been necessary to carry down the puddle trench; the excavation at one spot being no less than some 180 feet in depth, the strata traversed being greenstone (known locally as "whin"), soft sandstone, and shale. The minimum width of the trench is 6 or 7 feet at the bottom, gradually widening out as the surface is reached. The reservoir is formed of banks with internal and external slopes, 3 to 1 and 2 to 1 respectively; that on the inside being protected by beaching 2 feet in thickness, terminating in pitching 1 foot thick, running up to the top of the bank. The reservoir covers an area of 92 acres, and will have a water surface of no less than 86 acres, while it will hold 548 million gallons, or, taking the daily consumption of Glasgow at 50 million gallons, about eleven days' supply. It was commenced in the summer of 1886, and completion is estimated in some two or three years from now. It is lined with 5 to 1 concrete, worked in 12 feet lengths. It has been hand-mixed; being turned over twice dry and twice wet.

The Stability of Endothermic Compounds at High Temperatures.—Recognition of the nature of the processes attending chemical combinations and transformations is being gradually forced upon technicians by the otherwise unaccountable results of experiments devised with practical objects. Thus, as Professor Ostwald said, in the course of his address at the last meeting, in Halle, of the German Scientific and Physical Society, it is necessary to reconsider the dogma that high heats are competent to break up all compounds into their elements. This view is now seen to lack justification. What we do know about the stability of compounds is, on the contrary, that all which are formed with absorption of heat—endothermic compounds, in short—actually become more stable with rise of temperature, and *vice versâ*. It so happens that the majority of the compounds with which we are acquained are formed from their elements with evolution of heat—are exothermic, in effect—and these become more unstable with rising temperature; and so we have fallen into the opinion that this is always the case. Two most important compounds, however, cyanogen and acetylene, are formed from their elements with great absorption of energy; and these can be readily produced in quantity at the highest temperatures of the blast-furnace and the electric arc. It is obvious that this consideration operates very powerfully in respect of the practical dealings with cyanogen and acetylene, which are concerned with the recovery of the nitrogen of coal and the carburetting of coal and water gas, and even with the construction of illuminating gas-burners.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 11 & 12, 1892.

Mr. CHARLES HUNT, M.Inst.C.E., President.

REVIEW OF PROCEEDINGS.

The Incorporated Institution of Gas Engineers was last week favoured by the first burst of real summer weather which has been experienced in London this season; and it was doubtless owing in part to this good fortune in the important matter of climate that the members flocked in such a cheerful throng to Great George Street last Wednesday morning. The winter, with its prolonged fogs and dear coal and occasionally recalcitrant labour, had evidently not seriously depressed the spirits, or damped the powers for taking an interest in technical discussions, of the very business-like assembly which welcomed the retiring President of the Institution—Mr. G. C. Trewby—to the chair, which he only occupied for the time necessary for the disposal of the formal matters remaining over from the first year's existence of the young organization. So speedily were these votes taken, that Mr. Trewby was enabled to induct his successor—Mr. Charles Hunt—into the Presidential seat, and the new President had risen for the purpose of delivering his address, within ten minutes from the time that had been fixed for the commencement of the meeting. It is impossible, however, to proceed with a notice of the conduct of the affairs of the Institution by Mr. Hunt without placing upon record the indebtedness of the new association to the first President. It is not too much to say that Mr. Trewby, by his aid and influence exerted on behalf of the Institution, contributed most materially towards giving the organization that "good start" which it has undoubtedly made, and which ought not to be so difficult to follow up with a steady development in usefulness and interest. The Institution has to thank him in particular for marshalling in its support a brilliant group of technicians who had not previously come forward in this way, and whose presence in connection with it is the most effective demonstration of the fact that the young society is something more than a schism from an older organization.

The President has had a unique experience of this kind of office, having twice filled the chair of The Gas Institute—or rather, it should be said, of the British Association of Gas Managers. Among the memories that cling round these incidents of Mr. Hunt's professional career, perhaps the most pleasing is that of the impression created by his address of 1880, which was recognized at the time as one of the most masterly orations that had ever been delivered from the chair of the associated gas engineers of Great Britain.

After briefly paying the usual courtesies of an elective President, Mr. Hunt began his address by reminding his auditory of the Murdoch centenary; passing lightly over Murdoch's single achievement of applying coal gas to illuminating purposes, and pronouncing a few wise words on the subject of the man's peculiar genius. There is nothing concerning which more claptrap is commonly spoken than the respective values of mother-wit and schooling in the production of a great man, or of a man who does great things. Mr. Hunt put the matter very succinctly when he remarked that "the spread of education has no doubt done very much to increase our average working efficiency; but it cannot create a Murdoch or a Stephenson." We shall save ourselves much trouble by remembering that it is not the function of education to create anything, but rather to economize the time and labour of the student, and to train and equip the creative energy where it exists. Nobody more keenly felt the disadvantages of his want of training than Stephenson; and Murdoch must have groaned in spirit over many an hour of labour which a little previous instruction would have shown him to be hopeless.

The President soon left Murdoch and the early troubles of the pioneers of the gas industry, in order to discuss the very tangible legacy which these adventurers left behind

them in the shape of the excessive capitalization of old gas undertakings. Though the gas engineers of the past made many costly blunders, it was well pointed out by Mr. Livesey upon a recent occasion that it is hardly fair to make them bear all the blame for the most glaring cases of over-capitalization, which is a consequence of bad administration that one could wish rather than believe to be characteristic only of the remote past. It is not possible to give the President all he asked for the purpose of his comparison between the treatment of gas undertakings by companies and local authorities respectively. It may be true that the companies pay, on an average, about 7 per cent. for their capital; but the local authorities hardly get off for 4 per cent., as Mr. Hunt suggests. Surely, the extra for the sinking fund should have been added to this charge, because it is actually a present burden, although it is intended to come up again as a credit at some future time. There is an appearance of something like a "bull" in the presidential argument that if the local authorities get for 4d. per 1000 cubic feet of gas sold something which costs the companies 7d., the difference in favour of the former is "probably about 5d. per 1000 cubic feet of gas sold." This may be so; but a little further explanation seems to be wanted of how a threepenny saving becomes a fivepenny profit.

Mr. Hunt did not put forward these figures with a view to claim any superior merit for corporation management; but he did claim for the local authorities, for whom, as a class of gas proprietors, he has a natural partiality, that they are making a substantial provision for future eventualities by clearing off their capital liabilities. He argued that this must be for the better in any case; because if the first object of the provision should turn out to be an illusion, they will be all the freer to do many things —"supply gas at the cost of manufacture," or spend the money "in any other way that may appear advantageous." When one remembers the class of purposes for the application of gas revenues that have appeared to be "advantageous" in the estimation of the Corporation of Birmingham, and when one remarks how Birmingham is going to encumber itself with a big water-supply project, and bears in mind the example of Manchester and the appropriation of gas profits to the Thirlmere scheme, it is with a smile for the enthusiast who believes that if gas-works sinking funds should ever be found superfluous, the consumers of gas are even remotely likely to benefit by the discovery.

Mr. Hunt propounds the question whether something like amortization—total or partial, we may presume—should not be permitted for gas companies. It is an old query, of course, and is an idle one in the present state of the law of gas supply, except in regard to the voluntary relinquishment of some share of sliding-scale dividends, with the object of piling up a reserve, which might be regarded as a sinking fund in so far as to be held sacred for the last extremity of the concern. With this suggestion we heartily and strenuously agree, and hope the hint will not be lost upon those whom it may concern when the present pinch of dear coal, &c., is past. Statutory gas companies are not allowed to provide themselves with depreciation funds or to amortize their works at the cost of the consumer, as local authorities do. It is quite fair to put it in this way—that the higher burden of capital borne by the companies is, in part, a recognition of the fact that the proprietors are compelled to *stand by their risk*, whatever this may be; and it would not be an over-valuation of this risk to call it equivalent to 1 per cent. of dividend. It will take more than this for some years to build up to anything like a satisfactory figure the reserve funds of some of the gas companies that have been hardest hit by the recent and current troubles. We have never liked this depleting process; and we are inclined to go to the fullest extent with Mr. W. J. Warner, of South Shields, who has urged that the sliding scale should have the fullest play, while the reserve should be kept inviolate for transient needs. This is, however, a difficult question. It is all very well to say in general terms that gas company directors and proprietors should deny themselves of a point or two in the matter of dividend, for the sake of protecting themselves from adversity in the future; but what would you? Might it not be said with equal force that when a local authority acquire a gas undertaking, paying heavily for the goodwill, they ought to wipe this off, and bring the business down to its bearings before taking a penny out of the revenues in aid of the rates? Yet where has so much foresight been shown?

There is always a "fearful joy" in correcting a President in a matter of reference or quotation. Mr. Hunt brought in a remark about a "decremental rate of increase," which he described as something susceptible of adoption, and ascribed the phrase itself to Mr. George Livesey. Now, it is true that Mr. Livesey has been responsible in his time for some very startling and even terrifying things in connection with gas administration; but this phrase is not one of them, nor does it bear the meaning ascribed to it by Mr. Hunt. It originated in connection with the arbitration respecting the acquisition of the Birmingham gas supply by the Corporation; and as then employed, if we remember rightly, it was coined by an accountant to express a continuously diminishing rate of growth of a gas undertaking when the district approaches the point of saturation. Thus, an increase for the current year of 5 per cent., followed by an increase of 4½ per cent. next year, then by one of 4 per cent., and so on, would be very properly described as a "decremental rate of increase." The phrase did not, however, happen to please Lord Grimthorpe, then Sir Edmund Beckett, who was engaged in the Birmingham arbitration case; and so he contemptuously dismissed it as a sample of "arithmetic gone mad." That the invention of the term should be ascribed to Mr. Livesey, who, as we have understood, was only amused by it, is a striking example of the way in which history comes to be written.

The President next proceeded to comment upon the awkward question of the nominal illuminating value of gas, and ventured upon the generalization that "the richer the gas, the less economically it is used." For such a statement he will draw down upon himself the censure of many North British gas managers; but for this, secure in the appreciation and support of Glasgow, he will probably care little. These remarks led him naturally to the subject of carburetting by oil instead of cannel, which was to be so elaborated by the majority of the papers in the programme of the meeting; and he introduced some statements relating to the results of special experiments with oil gas, which ought to be read in conjunction with these papers. It is to be noticed that Mr. Hunt does not despair of the simple method of injecting oil into ordinary coal-gas retorts, after the charge has been partly carbonized—a plan which has few partisans among skilled technicians; but Mr. Hunt dearly loves a little paradox.

The subjects of labour and coal prices then occupied the attention of the President, who, while admitting, in general terms, the proposition that the stoker and the coal miner should be well paid, was careful to point out the reasons for his conclusion that the wages fund applicable to these employments is not illimitable. In asserting that wages in gas manufacture are now as high as they can be expected to stand for some time to come, Mr. Hunt stated a truth that the workers themselves will scarcely dispute. He rested upon indisputable facts when he declared that "there never has been a time when the reasonable and timely demands of gas workers have been denied;" and he might have gone further, and pointed out that improvements of position accorded to gas workers have never been taken away again during less favourable seasons for workers in general. This section of the address contains some very weighty and well-considered remarks upon the whole question of labour in gas-works, and the cognate subject of the employment—or rather of the very partial use—of labour-saving machinery in gas manufacture.

The President's remarks upon the important subject of gas testing and photometry were looked for with special curiosity, because he is known to hold strong opinions with regard to the Procrustean rule of the standard burner, consuming gas at the uniform rate of 5 cubic feet per hour. Expectation was not disappointed in this instance; for, with all the reserve due to remembrance of the circumstance that a presidential utterance is an *obiter dictum*, Mr. Hunt resolutely propounded his favourite theory that in all cases the height of the gas-flame in the standard burner should correspond with the maximum efficiency of this burner for the quality of gas under test. Whatever it may be worth, this contribution to the controversy of the day must be deemed timely and rational.

Of course, it would be impossible for a gas-works administrator to close a review of the condition of the industry without touching upon the "load factor," which

has of late being elevated into such prominence by the practitioners of a sister technology. It is one of the chief recommendations of this address that it is critical rather than historical or merely enumerative; and if Mr. Hunt had done nothing more with his great opportunity, he would have deserved well of his professional brethren, and those for whom they work, by laying the stress he did upon the "close relationship between economy of manufacture and duly-proportioned plant." There is much more in the remarks upon this head than meets the eye. Reading between the lines, it is easy to see that the speaker's object was to demolish the vulgar and pernicious notion that there is anything admirable in mere bulk, or despicable in smallness. Proportion, he tells his hearers, is all in all; and for those who miss this open secret, there is no redemption. Unfortunately, it by no means follows that the largest responsibilities fall to the most comprehensive minds. A critic was once brought to book for his hardihood in daring to call in question the administration of a gigantic undertaking. "Are you are aware," asked his questioner, "that the Directors of this Company all receive £30 a time for their attendance?" It was too true; how could perfect wisdom be missed at such a price?

With a few kindly words relative to the subject of the training of students in gas manufacture, which the speaker's official position in connection with the City and Guilds of London Institute rendered appropriate, and which it is to be hoped will bear good fruit, this really admirable address was brought to a close. It is not an easy thing to justify oneself upon all occasions; but when Mr. Hunt resumed his seat in last week's meeting, he must have felt, doubtless with immense relief, that he had done justice to the Institution and to himself.

As soon as the President had concluded his address, Mr. George Livesey rose for the purpose of moving a vote of thanks to him for it. This proceeding was, by a very thin fiction, supposed to be irregular; but the irregularity, having now been committed twice, may well be converted henceforward into a normal function. A president of a scientific or technical society deserves thanks for having undergone the tribulation of preparing and delivering an address; and the debt may as well be paid off at once as held over to another stage of the proceedings.

An important motion, having the character of a digression from, or rather of an addition to the regular programme of the meeting, was then introduced by Mr. W. Foulis, of Glasgow. It referred to the Committee upon the Standards of Light, and was intended to empower the Institution to make representations to the Committee, in the name of the Institution, and on behalf of the gas industry of the Kingdom, on the subject of the proposed substitution of another standard for the statutory candle. The resolution to take this step was adopted unanimously; as also was another authorizing the Council to carry it into effect. After this matter was thus satisfactorily disposed of, the reading of papers was proceeded with; Mr. George Livesey's being taken first. We do not propose to criticize the papers, or to comment upon the discussions this week. Enough to say that the character of the technical business transacted by the meeting during the day and a half devoted to this work, was particularly good, and such as to well maintain the reputation of the Institution.

The first day's business was wound up by the annual dinner at the Holborn Restaurant, which was a very enjoyable and satisfactory function. The fare and the company were alike good; and if next time the Council can manage to compress the programme a little, their arrangements will be still more admirable. There is an ever-present temptation to essay too much in the way of oratory upon these occasions; but the temptation must be resisted in the interest of humanity. The second day's work showed no abatement of interest. Unfortunately, the time available for discussion was cut rather short by the exigencies of the tide in the river, which had to be consulted with reference to the afternoon excursion. The President had chartered a steamboat which took the members and a few friends from Westminster Bridge to the Tower Bridge works, a free inspection of which was permitted by the contractors, Sir W. Arrol and Co. Luncheon was also provided on board the boat by the hospitality of the President. After leaving the Bridge works, the trip was continued to the East Greenwich station of the South Metropolitan Gas Company. The party was conducted over this large and fast-growing station by Mr. Robert Morton, as a Director of the Company representing the Chairman (Mr. George Livesey), who was unavoidably prevented from being present by his duties on the Labour Commission. Mr. Frank Livesey, the Chief Engineer, and Mr. Tysoe, the Engineer in charge of the station, also received the visitors, and explained what there was to see. Interest centred in the new six-lift holder now in progress of erection by Messrs. Clayton, Son, and Co., Limited, of Leeds, the contractors; and in the retort-working machinery, which comprised an illustration in action of the wire-rope power machines of Mr. West, and the new hydraulic power system of Mr. Foulis. The latter was only represented by the retort drawer, which is an admirably light, cheap, and efficient machine; but it was understood that the charging apparatus would soon be in place. It is unnecessary to describe the East Greenwich works in detail. They are now so far developed as to show the scale upon which the manufacturing operations will in future be carried on, and furnish a most instructive lesson in the art of filling out a generally uniform and settled scheme of gas works-construction, without excluding such improvements of detail as the progress of engineering science suggests from time to time.

The steamer then returned with the party to the "Ship" at Greenwich, where the Directors of the South Metropolitan Company entertained their visitors to high tea. The usual compliments having been paid and acknowledged by guests and hosts, the return from Greenwich up the river to Westminster brought the second meeting of the Incorporated Institution of Gas Engineers to a satisfactory end; and the members separated with mutual admissions of having spent a pleasant and profitable two days.

REPORT OF PROCEEDINGS.

The General Meeting of the Institution was held last Wednesday and Thursday, at the Institution of Civil Engineers, Great George Street, Westminster.

Mr. G. C. Trewby, President for the past year, took the chair at the commencement of the proceedings.

Annual Report and Accounts.

The report of the Council (which had been printed and circulated) was taken as read. The principal portions were as follows:—

In presenting the second annual report, the Council has pleasure in being able to congratulate the members on the continued progress of the Institution. Since the meeting in May last, 45 applications have been received for admission into the Institution. This satisfactory addition to its numbers shows the increasing favour in which it is generally regarded.

The Council regrets to record the loss by death of one member—viz., Mr. Neil Meiklejohn, of Longwood—and one associate, Mr. John Chapman, of Harrow.

The first volume of Transactions is now in the hands of members, and will be found a fitting record of the work done by the Institution. The programme of the forthcoming meeting includes matter of at least equal interest and importance.

The Council would again draw attention to the suggestion contained in the circular letter of Feb. 29, 1892, pointing out the desirability of members contributing papers, not necessarily for reading and discussion, but for incorporation with the annual issue of Transactions.

The proposal to hold an autumn meeting was reluctantly abandoned, in consequence of it being found that the time of year was inconvenient for the attendance of members.

In response to an invitation from the Royal Commission on Labour, the Council offered, on behalf of the Institution, the services of such members as it felt would be of assistance to the Commission in their consideration of matters affecting the gas industry.

Accompanying the report was the balance-sheet, as audited by Messrs. Alfred Lass, Wood, and Co., and Mr. Magnus Ohren.

Mr. C. C. Carpenter (London) moved the adoption of the report.

Mr. J. Methven (Beckton) seconded the motion; and it was carried unanimously.

New Members and Associates.

The Scrutineers reported that the whole of the gentlemen on the following list had been elected:—

MEMBERS.

Ball, T. B., Engineer, Gas-Works, Rochdale.
Belton, W., Engineer, Gas-Works, Shrewsbury.
Darwin, S. B., Engineer, Gas-Works, Portsmouth.

Edwards, A. J., Manager and Secretary, Gas-Works, Taunton.
Ennis, T. F., Assistant-Engineer, Gas-Works, Nine Elms.
Eunson, J., Engineer, Gas-Works, Northampton.
Eunson, G. S., Engineer, Gas-Works, Northampton.
Gandon, J., Engineer, Gas-Works, Smyrna.
Helps, J. W., Engineer, Gas-Works, Croydon.
Holgate, T., Engineer, Gas-Works, Halifax.
Hulse, W. W., Engineer, Gas-Works, Longton.
M'Gregor, W. S., Engineer, Gas-Works, Constantinople.
Milne, R. V., Resident Engineer, Gas-Works, Adderley Street,
Morley, H., Engineer, Gas-Works, Cardiff. [Birmingham.
Syms, W., Engineer, Gas-Works, Rochester.
Tindall, J., Engineer, Gas-Works, Walsall.
Wilson, A., Manager, Gas-Works, Dawsholm, Glasgow.
Winstanley, G., Engineer, Gas-Works, Coventry.
Woodward, W. W., Engineer, Gas-Works, Bromley, Kent.

ASSOCIATES.

Blackwood, H., Assistant-Manager, Hendon Gas-Works, Sunderland.
Pryce, E. Llewellyn, Chemist and Assistant, Windsor Street Gas-Works, Birmingham.

Mr. TREWBY said this finished the business so far as he was concerned. He had now the pleasing duty of asking Mr. Charles Hunt to take the chair, he having been elected President for the ensuing year; and he (Mr. Trewby) did not think the members could have made a better choice.

Mr. Hunt thereupon took the chair.

THANKS TO THE PAST-PRESIDENT.

Mr. THOMAS MAY (Richmond) then moved that the best thanks of the meeting be accorded to the retiring President, for his able conduct of the affairs of the Institution during the past year, as well as for his valuable assistance in bringing about its formation. He was sure it needed no words to commend this resolution. The members owed Mr. Trewby a debt which could never be adequately paid. He had given his time and influence, and had spared no effort in promoting the welfare of the organization. As a member of the Committee of the Council who had had some detail work to do, he could testify to the way in which Mr. Trewby had thrown his heart into it. At the very commencement, he allowed the use of his office, gave up his time, and used every effort to ensure the success of the Institution.

Mr. J. SOMERVILLE (London) seconded the motion; and it was carried.

Mr. TREWBY said he was much obliged to the members for the vote of thanks accorded to him. Whatever services he had been able to render had been given with hearty goodwill; and they would have been of little value if he had not been ably seconded by the Council, and especially by the Sub-Committee, who had all worked most eagerly in forwarding the interests of the Institution.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Allow me first of all to thank you for the great honour you have done me in electing me as your second President; in succession, too, to one whose high example I can only seek to imitate. It shall be my aim to maintain the prestige which he has secured for this infant Institution; and I rely with confidence upon your support in the endeavour to extend its usefulness.

It is scarcely possible to forget that this year completes the first century of gas lighting; and although too much might easily be made of the circumstance upon an occasion like the present, yet it must be admitted that much more than a mere academic interest attaches to the birth and growth of so great an industry. One might be excused for enlarging upon the public benefit which has resulted from its operation, or dwelling with complacency upon the many minor industries which are dependent upon it; but, at all events, the reminder will not be untimely or out of place, that its originator was a type of the men who have done so much for industrial progress. Owing nothing to birth or position, and almost untutored, except in the rough school of practical experience, he yet left behind him an enduring name and monument. The spread of education has no doubt done very much to increase our average working efficiency; but it cannot create a Murdoch or a Stephenson. The triumphs of Art and of Industry claim the exercise of a higher faculty than is implied by the achievement of scholastic distinction. Murdoch, seeing in the ordinary phenomenon of the combustion of coal just what everybody else saw, and yet realizing its significance as no one else did, gave evidence of his superiority in the possession of habits of close observation and restless inquiry, without which the utmost learning can avail but little.

Over the difficulties which beset gas lighting in its early days, or the perhaps more serious mistakes of its maturer years, there can be little need to moralize; although, if a real history of them should ever be written, it will doubtless be conceived, not in the spirit of the mere chronicler of events, but with a desire to inculcate the lessons it affords, and to show how further progress may be best ensured.

One principal legacy of the past is steadily, if not rapidly, disappearing. The capital outlay of the undertakings continues to diminish relatively to the business done. Comparing the Board of Trade returns for the years 1886 and 1890, the average reduction for the period, per ton of coal carbonized, is seen to be 7s. 7d. by the Companies and 16s. 2d. by the Local Authorities; the actual capital invested per ton of coal carbonized at the end of 1890 being: Companies, £5 19s. 3d.; and Local Authorities, £6 0s. 10d. The Local Authorities have, in addition, increased their sinking funds by an amount equivalent to 5s. 6·55d. per ton of coal carbonized—the total of their sinking funds now amounting to 20·96 per cent. of their capital outlay; so that their actual liability per ton of coal carbonized is only £4 15s. 6d. This, it must be recollected, is inclusive of large sums paid for goodwill, many of the undertakings having been purchased at a high premium; whereas the liability of the Companies represents nominal value only. The comparison may be stated in another way. It is probable that, taken together, the dividends and interest paid by the Companies average fully 7 per cent.; while the average interest paid by the Local Authorities must be less than 4 per cent. The invested capital being practically the same in both cases—differing only to the extent of 1s. 7d. per ton of coal carbonized—it follows that the capital charges of the Companies per 1000 cubic feet of gas sold compare with those of the Local Authorities as 7 : 4—that is to say, for every 7d. that it costs the Companies for dividend and interest, it only costs the Local Authorities 4d. for interest charges. The difference that this represents in favour of the latter is probably about 5d. per 1000 cubic feet of gas sold.

These figures are not put forward with any idea of founding upon them a claim for superior management on the part of the Local Authorities. They are but a natural consequence of the change of ownership by which the purchase-money of the undertakings became a debt, to be cleared off as soon as practicable. They have, however, a further significance. They show that the Local Authorities are making substantial provision for the future. What if this should prove unnecessary by the continued popularity of gas? "So much the better," is the answer. "We shall, at all events, have cleared ourselves of debt, and be free to supply gas at the cost of manufacture, or employ our resources in any other way that may appear advantageous." If, on the other hand, it should turn out to have been a wise precaution, what is likely to be the position of the Companies? Will it not appear that they also should have been making a similar provision?

When the sliding scale was under discussion a few years ago, it was suggested that, as this had operated so entirely in favour of the Companies, it might be desirable to voluntarily relinquish a portion of the dividends resulting from it. An additional argument in favour of this course was to be found in the fact that the dividend and interest charges of sliding-scale Companies were in some instances in excess of those of Companies working under the old legislation. Although little has yet been done towards the adoption of what Mr. George Livesey called a "decremental rate of increase," it is to be hoped that, with a return to more prosperous times, the idea may be revived, if only for the purpose of wiping out, by means of profit that would be thus unappropriated, some of the capital which is at present practically unrepresented by productive works. Having regard, however, to the present difficulty of maintaining dividends, it is of more immediate importance to consider in what direction relief may be looked for in connection with the cost of manufacture, so greatly enhanced by the recent rise in values both of labour and raw material. Although, as regards the latter, the difficulties of the present period are not to be

compared with those of the years 1872-3-4, when for a time coal was almost at famine prices, they bid fair to be in some respects more lasting. No one, it is true, believes in the permanence of present prices, notwithstanding the determined efforts of the miners to restrict the output. But only the most sanguine can anticipate a speedy return to the low level of a few years ago, even if this should be desirable; whilst the increasing scarcity of cannel points to the advisability of reviewing the position both as regards the continuance of such a high standard of illuminating power as is implied by the manufacture of cannel gas, and and also as to the use of enriching material in the production of common gas.

The example which was set by the Corporation of Glasgow a few years ago, in the reduction of its standard, might with advantage be followed where custom or statute continues to impose an illuminating power that, having regard to the conditions under which gas is ordinarily consumed, may be fairly described as wasteful. Whatever may be the exact value which the Glasgow consumer now receives, it is almost certain to be, relatively speaking, greatly in excess of that which he formerly realized under nominally a much higher standard. In addition to a reduction of the standard for cannel gas to a uniform 20 or 22 candles, the desirability of reform may be held to include an inquiry into the actual value of gas of such denomination as compared with common, or (say) 16-candle gas. Unfortunately, the means for making an exact comparison between the two gases are not readily available—which is almost as much as to say that our present methods of gas-testing are, for purposes of comparison, unreliable. It is, however, pretty certain that the richer the gas, the less economically it is used. Why not then seek to extend our lease, so to speak, of the material upon which its manufacture depends, by minimizing the waste that is going on. Local circumstances have in the past influenced the adoption of various standards in different parts of the country; but improved communication has now brought the products of various districts so much within common reach as to have paved the way for greater uniformity of illuminating power than at present obtains.

In the meantime, there seems to be a reasonable prospect of our finding in oil a good and reliable substitute for cannel. Oil has frequently figured at meetings of this kind as a powerful competitor of coal gas; but it will on that account be made none the less welcome in its new character of a friend. The valuable information as to its use which was contained in the presidential address of Mr. Trewby, and in the papers read at the meeting of the Institution last year, will be added to on this occasion by contributors who are in a position to speak authoritatively upon the subject; and may be expected to give the results of a more extended experience with regard to it than has hitherto been available. It is not to be expected, or even desired, that progress in a direction so foreign to previous ideas and practice should be otherwise than deliberate; but the advantages of a new and abundant supply of enriching material are too obvious to be disregarded. Were this supply likely to prove only temporary, its utilization for gas-making purposes would be a matter of secondary importance; but as all authorities appear to agree that it is practically inexhaustible, the prospective, if not the immediate, value of an alliance with it seems to be beyond question.

It is perhaps an advantage that the use of oil is not restricted to one particular method. Besides carburetted water gas and simple carburation, already adopted to a considerable extent, there are—oil gas made as described by Mr. Foulis last year, or in a double retort after Pintsch's method; and mixing the oil with common coal and carbonizing in the usual way, or injecting the oil into a coal-gas retort at some period of the charge. Which of these methods is the most economical it is our business to determine. As a contribution to the discussion upon the question may be mentioned some experiments made under my direction during the past year, which form the subject of a communication to this Institution by Mr. E. L. Pryce, who had the conduct of them. They relate chiefly to the manufacture of oil gas, for which a very simple apparatus—consisting of a single iron retort, 6 inches in diameter by 7 ft. 8 in. long, set in brickwork in the usual way, a condenser, and clean water scrubber—was employed. Perhaps better results might have been obtained with a double retort, although attended by increased cost of apparatus and possibly of fuel. It is likewise doubtful, also, if prolonged contact with a heated surface is attended with any benefit in the production of gas from oil, owing to its tendency to decompose. It has not appeared from these experiments that there would be any particular difficulty in working as many as eleven single retorts set over one furnace; each such retort being capable of gasifying about a gallon of oil per hour. As was to be expected, it was found that the production of carbon within the retort varied greatly with the kind of oil used, from which it may be concluded that success in the use of oil, for making either oil gas or carburetted water gas, largely depends upon its quality or previous preparation. With some oils, the retorts might be run almost continuously, or for days together without stopping; whilst with others they would require cleaning out every three or four hours. Another very important point is the regulation of the heat of the retort; any sensible variation of temperature greatly affecting the yield. Thus, in one case a difference in the average temperature of 245° Fahr. caused an alteration in the total luminosity obtained of rather more than one-third; the smaller yield corresponding, contrary to our coal-gas experience, with the higher temperature. It is very apparent, indeed, that oil, whilst advantageous from the facility with which it may be gasified under proper conditions, and its almost absolute freedom from impurity, requires careful handling. At present prices, there is little or no margin for unskilful treatment. The total residuals—solid and liquid—vary greatly, according to the temperature of the retort; in one case amounting to 68·1 per cent., a quantity which was reduced under more favourable conditions to 30 per cent. It is a drawback that these residuals are at present valueless; although the tar contains a small quantity of benzol or other light product, which in the opinion of some it should pay to recover. As, however, light oils of the paraffin series are also present in the tar, which are objectionable to the colour manufacturer, it ought not to be mixed with coal tar; so that, contrary to an opinion expressed during the discussion upon this subject last year, the two gases—oil and coal gas—should be kept apart until all condensable matter has been entirely removed from the former. It is then the finished article, requiring neither scrubbing nor purifying.

The cost of enriching common gas by means of oil gas can scarcely be determined by ordinary methods; but, accepting the illuminating power of the enricher as arrived at by means of the most suitable burner, it works out at from about 0·86d. to 1·56d. per candle per 1000 cubic feet for material alone. This is probably an excessive estimate; since by comparing the analyses of the various gases with their ascertained illuminating power, it is found that whereas common gas yields something like 4 candles for every per cent. of hydrocarbons absorbable by bromine, the richer gases, tested with the most favourable burner, yield less than 1¼ candles. This may be due to some extent to a difference in the composition of the hydrocarbons; but much must also be attributable to the method of testing, which is unfair to the richer gases. A more satisfactory plan would be to mix the rich gas in definite proportions with gas of a very low quality, testing both the latter and the mixture with an equal height of flame in the standard burner, and correcting in each case to the 5-feet rate. It is not improbable that better results than were obtained in these experiments may follow from our further experience; the preparation of the oils, as well as the mode of gasifying, being of much importance. The investigation should prove not only interesting but profitable also to those who have time as well as inclination to pursue it.

The doubts which have been expressed as to the economy of injecting oil into coal-gas retorts after the charge has been partly burnt off are not to be wondered at, considering the difficulty which is constantly experienced in following the effect of any departure from the ordinary method of carbonizing. Even in the laboratory, no amount of care will prevent the most conflicting results being occasionally obtained; and it can therefore be no reproach if working results do not always appear as intelligible as could be wished. It is probable, however, that the last has not been heard of this method of using oil. Much no doubt depends upon the temperature of the retort at the time the oil is introduced; and my

experiments show that—at least, as regards those oils under test—a temperature which is fairly suitable for coal is uneconomical for oil. Yet, mixtures of coal and oil, carbonized in the ordinary way, have yielded experimentally an increase of luminosity over the same coal alone, equal to nearly double that which is shown can be obtained by the more roundabout process of gasifying the oil separately; the cost of enriching by this plan working out at the low figure of 0·5d. per candle per 1000 cubic feet. May not this result be attributable, in part at any rate, to the more perfect utilization of the illuminating constituents of the oil, consequent upon their being protected from decomposition by the surrounding gases evolved from the coal, and which are necessarily of a lower temperature than the retort itself? Is it unlikely that a similar protection, although in a lesser degree, is afforded in the manufacture of carburetted water gas; thus accounting for any economy in the development of luminosity from the oil which this process may possess? While it is doubtful if heavy crude oil can by any process be successfully gasified, owing to the large quantity of carbon it deposits, on the other hand simple carburation with very light oils, having a vapour tension at least higher than that of benzol, bids fair to rival in economy all other methods of using oil, as it excels them in the convenience with which it can be applied. There should be practically no limit, except the carrying power of the gas, to the employment of such a ready means of maintaining a uniform illuminating power, based upon a supply of oil which may be said to be a residual of other manufactures, and is capable of being wholly utilized for the purpose without residuum of any kind. Every candle added to common gas by its means should represent about 7 per cent. increase in productive capacity, without any appreciable cost for plant, and almost without labour.

This question of labour has not lost any of its importance during the past year; and the proceedings of the Royal Commission, upon which the gas industry is so fitly represented by Mr. George Livesey, have been followed with undiminished interest. The information which has already been collected as regards other industries promises to be of considerable value. The action taken by the Council of this Institution, as to evidence relating to our own industry, has been made known through its report; but it may be desirable to urge the importance of assisting the Commission by placing before it the fullest information, either of a special or general nature, as affecting gas-works management. It will probably be found upon inquiry that the improvement which has taken place during the last few years in the position of the gas worker is almost, if not quite, without a parallel in the case of any other employment. This should afford the strongest proof of a desire to place upon the best possible footing an occupation which may be none of the best, but is certainly not the worst that can be met with. There is, of course, a limit to the concessions that can be made without prejudice to the prosperity of the industry; and it is probable that this limit has been reached for some time to come. When everything is in good demand, it is but right that all should share in the general prosperity; but high wages and high prices for coal, without corresponding receipts for residuals, mean dearer gas. Dearer gas means restricted consumption; and restricted consumption means less employment. These are facts which the miner, even more than the gas worker, needs to bear in mind. He has become imbued with the belief that the railway and gas companies are mainly responsible for low prices of coal, and that they derive all the benefit therefrom, and can well afford to pay higher prices. No one can possibly desire that the gas or any other industry should prosper at the expense of another, either as regards the men engaged or the capital invested in it. All must wish that both the one and the other should be adequately remunerated—the miner especially, for his toil and risk. Is "cheap" coal incompatible with this? Cheap coal has made our industry what it is; and without it there must be less work for the stoker, and less work for the miner. If anyone doubts this, let him compare the consumption of gas under the influence of comparatively high prices, such as prevail on the Continent or even in America, with that which obtains in English towns of corresponding importance.

Speaking as one finds, there does not appear to be any reason to believe that the men as a body are unmindful of the great improvement which has been effected in the conditions of their work, or have become less amenable to fair and considerate dealing. It is true that here and there conditions have had to be met which are in some respects novel; and there is a general disposition—occasionally manifested by proceedings more or less demonstrative—to attribute all that has been gained to the action of the newly-formed Trades Unions. Without in any way deprecating Trades Unionism—since, not only have all men an equal right to form combinations for any legitimate purpose, but such combinations may, under certain circumstances, be beneficial alike to employers and employed—the claim which has been put forward on its behalf may fairly be disputed. It can be said with perfect truth that there has never been a time when the reasonable and timely demands of gas workers have been denied them; and the events of the last few years form no exception to this statement. The mischief in these combinations is principally to the men themselves, and arises out of the temptation, not uniformly resisted, to rely upon the representations of interested agitators rather than upon their own natural shrewdness and good sense. It is not the principles of Trades Unionism so much as the abuse of them, which may be the cause of misunderstanding. A Trades Union should be a guarantee of efficient work on the part of its members; but when put forward as a mere fighting organization, it is entitled to just as much respect as it can win by the sword, and no more.

With the insight it will have gained into the feelings and aspirations of both sides, the Commission will doubtless be enabled to form a clear estimate of the position; and may, it is to be hoped, see its way to some practical recommendations, if only for the settlement of disputes without recourse to the unsatisfactory arbitrament of a strike. Expectation in this direction should not, however, limit the consideration in the meantime of any plan that may be already in progress for the improvement of the relations between capital and labour; and in this view, Mr. Livesey's profit-sharing scheme commands attention by the prospect it seems to afford of a firm and lasting union of interests. It is one of a group of subjects bearing upon the welfare of the wage-earning classes which is of growing interest; and the influence of which cannot fail to be felt, either directly or indirectly, by all who stand in the position of employers of labour.

Satisfaction, however, at any signs of amelioration cannot limit the obligation to discharge the bill which may be expected to follow. Mr. Field's "Analyses of the Accounts of Gas Undertakings" are always interesting, if they are not invariably pleasant reading. Thus, the Analysis for 1890 shows, by comparison with previous records, the extent to which cost of production has already been influenced by the recent labour movement. At the the same time, it shows that this influence has been by no means equally felt by the various undertakings under review. On page 1¼, part 2, for example, under the heading of "Wages (carbonizing)," a difference is now seen of not less than 2s. per ton of coal carbonized between the highest and the lowest on the list—the figures being 3s. 10·77d. and 1s. 10·73d. respectively. It is not difficult to recognize in the one case an extensive use of machinery in the retort-house, and in the other the predominance of hand labour; but what can there be to justify, as regards the latter, an expenditure of more than double that which has been proved by experience to be sufficient for the same work? It is not easy to account for the little real progress that has been made in the employment of stoking machinery. Even the simple machines that have for a long time been available are in use only to a very limited extent; notwithstanding that it has been clearly proved that they may be profitably employed in almost any works of moderate size. Even where circumstances favour a continuance of hand charging, the drawing machines may be used by themselves with appreciable economy. This equally holds good where the manufacture is upon a larger scale, and with the added advantage to be derived from steam or other motive power. For nearly nine years (with the exception of one or two brief intervals) machine drawing in conjunction with hand charging has been in operation under my direction. During that time, about 900,000 tons of coal have been carbonized by this system—four machines doing the whole of the work of nearly 750 mouthpieces. With these machines, one man (with another to attend to the lids) can draw at a

maximum rate of fully 100 mouthpieces in one hour; and 656 have been regularly done as a day's work for one machine. The total saving in labour has already amounted to nearly five times the original cost of the machines and their equipment complete.

Those of us who are not committed to machinery have now the choice of another method by which hand labour in the retort-house may be minimized. To build the retorts at an angle that will enable them to be charged and discharged by gravitation, is but following out the idea that must always be present in the mind of the constructing engineer who in designing works desires to afford the utmost possible facilities for the handling of material with economy, consistently with a due regard to the cost of construction. After everything practicable has been done in furtherance of this object, then only should machinery be resorted to. Upon the assumption of their practicability, there can be little difficulty in giving the preference to inclined retorts over horizontal retorts drawn and charged by machinery. The absence of machinery more or less complicated, is of itself no small advantage, having regard to wear and tear and liability to breakdowns. It was hardly to be expected that the new system would at the outset give uniform satisfaction—seeing how little beyond the idea of an inclined retort there is in the original arrangement of M. Coze that can be followed with advantage. Where, however, an independent line has been taken with regard to the details, it appears to have been generally successful. A cost of about 1s. per ton for conveying the coals, charging and drawing the retort, and wheeling away the coke, with no machinery to keep in order, would effect an appreciable improvement in many a balance-sheet; and this is not an ideal figure, but one derived from actual practice.

The subject of gas-testing, already incidentally referred to, has become additionally prominent by the appointment, at the instance of the Board of Trade, although at the sole cost of one of the London Companies, of a Commission to determine the very vexed question of a substitute for the sperm candle as a standard of light. It is significant of the slow growth of public opinion that only now, after so many years of agitation, do we seem to be within measurable distance of the adoption of a "candle" without a wick, and of invariable composition. But it is scarcely satisfactory that a matter of such general importance should be proceeded with as though it affected the London Companies solely. It must be the business of all gas undertakings—Provincial as well as Metropolitan—to assure themselves, not only of the practicability for every-day use of whatever may be proposed as the future "candle," but also that this shall fairly represent the unit of light as expressed and understood by the parliamentary definition of a standard candle. Equally important does it seem to be to determine whether the gas is at present consumed in the testing burner under the same conditions as formerly, and also how far the deficiencies of this burner may be remedied so as to justify its title of "standard" burner.

This burner, as has been known almost since its introduction, is not capable of giving, with the same sized chimney, comparable results under varying rates of consumption or different qualities of gas. Throughout its range, the air supply is in excess of the requirements of luminous combustion; such excess becoming more and more marked as the flame is reduced in height. An exaggerated effect is thus produced by any alteration in the height of the flame from whatever cause. This is doubtless the case with all Argands; but not to the same extent. For example, the objection would have but little practical importance if applied to the French standard burner, the Bengel, which, at its maximum efficiency, has a range of consumption of fully 3-4ths of a cubic foot, with a variation of only ¼ of a candle; whereas the English standard shows a difference within the same range of consumption of fully four times as much. Compared with itself, it is almost unnecessary to say how variable is the tale which this burner is found to tell under alterations of the height of flame in the chimney. Thus, gas having a value of 3 candles per cubic foot when tested at the 5-feet rate gives 3·25 candles per cubic foot, with the chimney fairly full; sinking to 1·08 candles, and even to 0·23 candle per cubic foot when consumed at the rates of 3 and 2 cubic feet respectively. In like manner, gas having an illuminating power of about 10 candles, when tested at the 5 cubic feet rate, develops upwards of 14 candles if tested with the chimney fairly full, and afterwards corrected to 5 feet. Whilst height of flame checks the tendency to excess in the air supply, it is not, as has sometimes been supposed, an unfailing index to illuminating power. It varies not only with the consumption, but also with the composition of the gas—such as the presence or otherwise of carbonic acid; or as resulting from the use of different coals, or the temperature employed in carbonizing. It follows that there cannot be uniformity of testing with the 5-feet rate, because the gas which burns with the longest flame for equal luminosity is tested to greatest advantage, owing to its being the least subject to depreciation from excess of air. As to what should be the height of flame in the chimney, is a question that must be answered in accordance with the views that may be entertained as to the desirability of securing practical uniformity of testing for all kinds of common gas. Respecting this, however, there can scarcely be two opinions; and there is only one known method by which it can be done, so far as the burner is concerned—namely, by making the height of the flame in all cases to correspond as nearly as practicable with the maximum efficiency of the burner. This would free the tests from any disturbing influences affecting the height of flame, and bring commercial testing into line with the most approved practice in experimental work involving comparisons between different gases.

It is at once apparent that the adoption of such a method, whether accompanied by retention of the 6-inch chimney or by the employment of a different height of chimney according to the quality of the gas, as suggested by me during the discussion upon a paper by Messrs. Hartley and Heisch in 1884, would be an advantage to the Companies, inasmuch as all gases below about 17 candles would be assessed at a somewhat higher value than under the present system; and some may be disposed to regard this as an objection to the proposal. It was, however, in no such spirit that the present standard burner was substituted for one less favourable to the Companies. It was said in effect, if not in words also, that the Companies were entitled to have their gas tested with the best practicable burner. May it not with equal justice be urged that they are also entitled to the best of which this burner is capable under practicable conditions? It is scarcely conceivable that so reasonable a plea can be denied, and with it the establishment, once for all, of a really National, because uniform, system of gas testing, or that this great opportunity for a permanent settlement will be dwarfed to the necessities of 16-candle gas.

It may appear inconsistent to couple together as characteristic of the present position of gas lighting such apparently opposite conditions as increasing severity of competition and unchecked growth. Yet such a description would not be very far from the truth. At one end of the scale of consumption electric lighting, and at the other oil, find increasing support; but between the two gas continues to occupy an apparently impregnable position, but little disturbed except by the exigencies of the demand for it, and the dimensions which its manufacture has assumed. There can be little doubt that the additional uses to which gas is now applied have brought in their train greater fluctuations of consumption than were experienced only a few years ago. That this was likely to be the effect of an extended use of gas for heating purposes, necessitating more rather than less storeage, was suggested by me at a time when the opposite opinion seemed to be in favour, and the increasing sensitiveness of consumption to variations of temperature indicate what is to be expected if gas should ever come to be used more largely for heating than for lighting. It is to be hoped that this time is very far distant. Lighting, and particularly domestic lighting, is, and must continue to be, the principal stay of the industry. Without domestic lighting, which extends throughout the year with almost exceptional constancy, the "load" upon a gas-works would be almost too variable for economy; and this gives additional point to the efforts that are being made for its extension. Whether these efforts take the form of collections at short intervals or prepayment meters, is of little consequence, provided the object be attained. But independently of either method of securing additional consumers, it seems that a gas undertaking may by its ordinary mode of conducting its business either attract to itself a very numerous class of customers, or limit its connection to the comparatively well-to-do.

That both policies are reflected in varying degrees by the statistics of the undertakings, does not admit of much doubt. The range of consumption should be fairly indicated by the average quantity of gas used per consumer, because the wider this is the lower must be the average, owing to the larger number of small consumers necessarily embraced. From the Board of Trade returns, it appears that in the case of the provincial undertakings having more than 5000 customers, and supplying common gas, this average varies as much as from 11,000 to 64,000 cubic feet per customer per annum. The lowest figure corresponds to nearly six times the number of customers, as compared with the highest, for the same consumption. It would be difficult to account for so great a difference by purely local circumstances, such as conditions of trade or occupation. The average quantity used by London consumers reaches still higher—namely, to 85,000 cubic feet per consumer.

Whether the limits of economy in gas manufacture are or can be reached in the scale upon which it is conducted, is an interesting question from more than one point of view. Administratively as well as commercially, it is of the highest importance; and to the engineer, it suggests possibilities in the shape of huge plant that may at no distant date become realities. It can hardly be doubted that there is a more or less close relationship between economy of manufacture and duly proportioned plant. Otherwise, it might be difficult to account fully for the very satisfactory position of some of the smallest undertakings as compared with that of their much more important neighbours, possessing every advantage which manufacture upon a large scale is supposed to give. I do not offer any apology for once again referring to the Board of Trade returns. These show that out of 52 undertakings supplying gas at less than 2s. 6d. per 1000 cubic feet, 34 carbonize under 50,000, and no fewer than 24 under 20,000 tons of coal per annum. Generally, in the case of such works, the relationship referred to is practically recognized by the substitution of larger rather than the duplication of existing plant when the necessity arises for increased producing power. When this is neglected, undue expenditure is almost certain to result. At the works of which I took charge just twenty years ago, a policy had been followed of providing for present needs by making small additions to the plant from time to time with as little disturbance as possible of existing plant. How it succeeded is now a matter of history; but the result might have been different had the Company possessed an exclusive area of supply, as well as a sufficiently high maximum price for gas; because then the consumers and not the shareholders would have paid the penalty. Suppose, however, for a moment, that it had been continued. What would now be the position, with an output increased nearly threefold? What satisfaction could there be in the management of a works which for the production of about 11 million cubic feet per diem required (say) 3000 mouthpieces, 70 purifiers, 30 gasholders, and minor plant to correspond? It may be objected that this is a fancy picture; but is it more unreal than the original from which it is drawn? What, frequently, are large works but aggregations of smaller ones; or large undertakings, but multiplications of comparatively small separate works? It is hardly to be expected that economy of manufacture should under such circumstances keep pace with the tonnage of coal carbonized. Other reasons render it no less imperative that the day of small things in the matter of plant should come to an end. Large plant is much easier to manage than small plant—as all who have had experience of it can testify. It is only by its means that manufacture can be satisfactorily conducted upon a large scale. Moreover, the tendency to concentration, as opposed to the more costly plan of establishing new works, every few years has to be reckoned with, and the best must be made of it. The best is made of it by every departure from the limits which custom or tradition has too often been allowed to impose upon the size or capacity of apparatus; and by the expansion of our views in this respect in sympathy with the demand.

It is gratifying to note that in one important particular a very notable advance is in progress. The era of large gasholders, initiated by Mr. George Livesey, has at length fairly set in; and the satisfaction with things as they are, sententiously expressed by the objection "Too many eggs in one basket," must have been rudely shaken by the growing frequency of structures which, however much they may be open to criticism from an æsthetic point of view, leave little to be desired as an indication of further possibilities in the same direction.

The importance of a thorough training as a preparation for the duties of a gas-works manager was never more apparent than at the present time, when many new subjects are pressing to the front, and the possibilities of further economy are becoming more and more narrowed to such as can only be attained by superior skill. As Examiner in Gas Manufacture for the City and Guilds of London, I have been impressed not only with the evidences of improvement in the quality of the candidates for examination, but also with the desirability of securing, if possible, a still higher standard of qualification. It is to be presumed that most if not all of those who present themselves at these examinations aspire to occupy, at some time or other, positions of responsibility in connection with gas undertakings. I would say to all such: "Do not undervalue the profession to which you seek to attach yourselves, nor think it sufficient to possess what is called a 'practical' knowledge of gas making; but endeavour to the best of your ability to perfect that groundwork of knowledge without which success is likely to be but partial." Our profession is a peculiarly democratic one, inasmuch as its ranks are open without reserve to the deserving of all grades, and the steps in it are many and varied; but this facility of entrance might become a danger even to the industry itself, unless safeguarded by a consciousness of what is due in return. It is not too much to ask of our recruits that they bring with them, not only an intention to succeed, but also the best earnest of that intention in the shape of a store of such well-ordered knowledge as may be usefully applied to their work.

It should be well within the province of this Institution to build upon the foundation thus adequately prepared. Its constitution provides for the admission, either as Students or Associates, of all who have entered the lists, either by way of a regular pupilage, or in the ranks of service, and who may reasonably look to it for example and guidance. Without taking upon itself the functions of an examining body, the encouragement by the Institution of work done by its younger members could not fail to be of essential service to the latter. Nor is there before it any task more honourable than that of influencing, and in some measure directing, the rising current of thought and activity thus represented; so that the burden now resting upon our shoulders may continue to be borne, lightly and triumphantly, on to a higher and yet more imposing level.

Mr. G. Livesey said he felt bound, as he did last year, to break the rule that all votes of thanks should be deferred till the close of the meeting, because he did not think that the admirable address to which they had just listened should pass without immediate recognition. It was no easy matter to prepare an address for a meeting of gas managers. Addresses were very plentiful now-a-days; and for any man to produce an address which was both interesting and useful was a most difficult task. Mr. Hunt had succeeded beyond their expectations—and they were by no means low; and he had much pleasure, therefore, in proposing that the heartiest thanks of the meeting should be tendered to the President.

Mr. R. Morton (London) said he had great pleasure in seconding the motion, for the address must be very helpful to all, especially to the younger members.

The motion was carried unanimously, and briefly acknowledged by the President.

Standards of Light.

Mr. W. Foulis (Glasgow) said he had been deputed by the Council to bring forward the following resolution: "That, inasmuch as any alteration made in the standard of light for the Metropolis will, in all probability, be also legalized for the United Kingdom, this Institution, as representing the gas industry, respectfully submits that, before any alteration in the standard of light, or the value of the same, be made, an opportunity should be afforded for this Institution to be heard on the subject." He said he need not use many words in recommendation of the resolution. The subject was one which they all felt should be settled on a sound basis; and they were very hopeful that the action recently taken by the Board of

Trade, in appointing a Committee, might have this effect. They had every confidence in the ability of the gentlemen who composed the Committee; and he felt sure they would not come to any conclusion without very careful inquiry. At the same time the Council felt that, in all probability, an expression of the views and opinions of the Institution might not only help them to arrive at a decision, but might also make that decision more acceptable, and more readily adopted, than it would otherwise be.

Mr. A. COLSON (Leicester) seconded the motion; and it was at once carried.

Mr. W. W. FIDDES (Bristol) thereupon moved—"That the Council be and are hereby empowered to take such steps as they may deem necessary in furtherance of this resolution."

Mr. H. PEATY (Burslem) seconded the motion, which was also carried unanimously.

Mr. G. LIVESEY, as a member of the Committee, said he was quite sure they would be very glad to receive any representation on the subject from the Institution.

READING OF PAPERS.

The reading of papers was then commenced. They were taken in the following order:—

Wednesday.—(1) "The Failure of the Wages System, and its Remedy—Profit-Sharing." By GEORGE LIVESEY, of London. (2) "Notes on Oil-Gas Manufacture." By A. F. BROWNE, of Rotherhithe. (3) "The Use of Oil for Carburetting Gas." By Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich. (4) "Notes on the Enrichment of Coal Gas with Liquid Hydrocarbon." By T. S. LACEY, of Pimlico. (5) "The Comparative Value of Various Oils for Enriching Coal Gas." By E. LLEWELLYN PRYCE, of Birmingham.

Thursday.—(6) "The Technology of Water Gas." By T. GOULDEN and A. M. PADDON, of London. "(7) A Description of a Six-Lift Gasholder and Tank in course of Construction at East Greenwich." By FRANK LIVESEY, of London.

These papers are given in another part of the JOURNAL; the report of the discussions to which they gave rise being held over till next week.

At the close of the discussion on Mr. Frank Livesey's paper on Thursday, the general business was resumed.

APPOINTMENT OF SCRUTINEERS.

The PRESIDENT proposed—"That Messrs. M'Minn, Lacey, Tysoe, and Price be asked to act as Scrutineers for the ensuing year."

Mr. TREWBY seconded the motion; and it was carried unanimously.

VOTES OF THANKS.

The PRESIDENT next proposed—"That the best thanks of the meeting be given to Mr. Forrest, and to the Institution of Civil Engineers, for their kindness in allowing the Institution to meet in that room." He said the comfort of the meetings was greatly enhanced by their being able to assemble in such suitable premises; and the least they could do was to accord a hearty vote of thanks for the facilities afforded.

The proposition was at once agreed to.

Mr. R. MORTON said the members had all been very highly gratified with the success of the meetings, but much of this depended on the way in which the Council did their duty beforehand; and therefore he begged to propose that the best thanks of the meeting be given to them for their exertions during the past year.

The motion was unanimously adopted.

Mr. TREWBY said the President told him it was his duty to respond to this resolution; and he could only say that it was a great gratification to the Council to know that their exertions had been attended with so much success. They had been ably seconded by the Sub-Committee, who had all worked heart and soul to bring about the prosperity of the Institution.

On the proposition of Mr. C. TAYLOR (Derby), the thanks of the meeting were given to the Scrutineers for their services during the past year; a similar compliment being paid to the Auditors (Messrs. Alfred Lass, Wood, and Co., and Mr. Magnus Ohren).

The PRESIDENT said he had finally to propose that the best thanks of the members be accorded to the Secretary (Mr. Thomas Cole, Assoc.M.Inst.C.E.) for his able services during the past year. They all knew how much depended on the work of a Secretary for the success of an Institution of that kind; and Mr. Cole had shown throughout the year a very hearty desire to further its interests in every possible way.

Mr. GLOVER seconded the motion; and it was carried unanimously.

Mr. COLE said he was very much obliged for this mark of confidence, which was extremely encouraging. He could most heartily endorse what had already been said as to the work done for the Institution by the Council and the Sub-Committee. The effect of that work was only seen in the result; but he should like the members to know how much was done by the Committee to advance the affairs of the Institution. They had had a great number of meetings—some beginning at two o'clock and not concluding until nine at night. As long as he remained Secretary, he should feel the greatest pleasure in fulfilling his duties to the best of his ability.

Mr. C. GANDON then proposed a vote of thanks to the President, which was carried by acclamation.

The PRESIDENT, in response, said that if he had in any degree succeeded in satisfying the meeting, he was perfectly content. He was fully aware of his shortcomings, and of the kind indulgence of the members towards them. If anything he had done had promoted the business of the meeting, he was amply rewarded.

The proceedings then closed.

PAPERS READ AT THE MEETING.

THE FAILURE OF THE WAGES SYSTEM OF PAYMENT, AND THE REMEDY—PROFIT-SHARING.

By GEORGE LIVESEY.

If the wage-hire system has not failed, why are Capital and Labour at war? The community is rapidly becoming divided into two hostile camps, represented by that most unfortunate expression the "masses" and the "classes." There is a strong conviction amongst workmen, and not without foundation, in some cases at least, that they have not received a just share of the wealth they help to produce. The supreme and pressing importance of mutually advantageous and cordial relations between employers and employed to the industrial welfare of the nation, and to the special industry of gas making, is the sole justification for presenting this paper for the consideration of the members of the Incorporated Institution of Gas Engineers.

Capital and Labour are so interdependent and indispensable to each other, and have such a real identity of interest, that the undoubted fact of their antagonism indicates something radically wrong in the system of payment by wages. There is, in fact, something wanting to bring the buyers and the sellers of labour into accord. Both parties are, unfortunately, too prone to take a narrow, short-sighted, and purely selfish view of their respective interests. The *Daily Chronicle*, which takes the side of Labour, said (but certainly not approvingly), in a leading article on Feb. 25, 1891: "Just now, Labour has but one object—to do as little work as possible, and get as much money for it as it can." And employers too often have endeavoured to get the largest amount of work for the smallest pay. The fact that a considerable proportion of workmen—to their credit be it said—are industrious men, who do their duty faithfully and honestly, and do take an interest in their work, may be adduced as evidence that the above statement is unsound. But of large numbers it is, unfortunately, impossible to say as much. With them, therefore, constant supervision, coupled with the fear of losing their employment, are necessary to stimulate them to do a moderate amount of work.

The payment of wages in return for labour merely purchases the time of the labourer, and does not purchase or secure in any way an intelligent interest in his work, or any desire for the prosperity of his employer. On this point, some quotations from an "Address by Mr. Albert Grey to the Labourers on East Learmouth Farm, 30th October, 1891," are to the point. The former tenant maintained that the farm could not pay, so Lord Grey allowed Mr. Albert Grey to take it in hand. He adopted a simple form of profit-sharing, which five years' experience

has shown to be highly satisfactory to all concerned. The address is well worth reading; it is published by the *Alnwick and County Gazette*. In speaking of the wages system in vogue in Northumberland, where hirings are made for a year, and where the wages and other conditions of employment are much better than in other parts of the country, Mr. Grey says: "I do not think human ingenuity could draft a contract better calculated, in the majority of instances, to steal away from a hind that interest he might naturally be inclined to take in his work; for, under the agricultural labour contracts which obtain in Northumberland and the Lothians, no inducement is given to the majority of labourers to interest tnemselves in the business of their lives. . . . . There is no sufficient incentive to cause a man to put brains and energy into his work. The relation between the amount of his wage and the prosperity of the farm, is so faint and remote as not to weigh with him at all. It matters not to him whether the harvest be good or bad. It makes no difference to his wage. So long as his employer's solvency is assured, it is no concern of his whether the farm prospers or not . . . . there is no inducement provided by the healthy and powerful stimulus of self-interest for the agricultural labourers to concern themselves about the efficiency of their labour. . . . Now, a system which tends to degrade an active, thinking man into an automaton, must be wrong. What we want is a principle which is capable of transforming an automaton into a man; and that principle, unless I am altogether mistaken in my views of human nature, is the one that prevails on this farm. What is that principle? It is one which says, if any profits remain after the claims of capital and labour have been paid, they shall be divided in a fair proportion between each. The effect of this principle is to make every one of you, after you have given one year's apprenticeship to the farm, partners with me in the profits of the farm." The result is a most striking success all round. The rent charged to the former tenant has been regularly paid; also the interest on capital. The labourers have, excepting one year, received bonuses ranging from 5 to 6¼ per cent. on their wages. Capital has received additional interest; a considerable reserve fund has been formed; while the manager, the steward, and the shepherd have also justly participated in the bonus.

But the want of interest on the part of the labourer in the prosperity of the business by which he lives, is not the worst result of the system. In the last annual report of the Labour Association for promoting Co-operative Production—an Association, by the way, of working men, who also advocate the principle of profit-sharing—there is the following ominous sentence: "Already in some industries, and before long in others, it appears likely that organized labour and organized capital will stand face to face in a position alternating between that of armed peace and open war. But like two hostile, though neighbouring nations, each is essential to the welfare of the other; and the question arises, with ever-growing importance, How will their interests best be harmonized?"

If these statements of the defects of the wages system are true, a remedy ought to be applied without delay. That remedy, or at least an important step in the right direction, appears to be profit-sharing, which is simply conceding to the labourer, over and above his regular wages—not as a gift, but the right to a certain proportion of the surplus profits he helps to earn, after interest at a fair rate has been paid on the capital employed.

It has often been urged as a conclusive objection to profit-sharing, that it ought to be accompanied by loss-sharing, which it is said is impracticable. But if there are no surplus profits, the labourer loses his bonus, and thereby loses the payment for the interest and energy he has put into his work. Moreover, he already shares losses in a very real manner; for wages fall as profits are reduced, and, if profits disappear, the labourer must ultimately lose his employment. Therefore, as a necessary consequence, has he not a just claim to a share in surplus profits when they are made?

It may be contended that under such sliding-scales for the regulation of wages as exist in the coal and iron trades, or the arrangement in the cotton trade, where wages rise and fall with the market values of the coal, iron, or cotton cloth, justice is done to the workman. But although these systems are in many cases successful, they do not go far enough; for wages being governed solely by the selling price of the product, over which the workman has no control and the employer very little, they fail to give the workman any inducement to put brains and energy into his work. Thus both employer and employed lose an important source of profit, quite independent of the fluctuations of the market. Piecework also falls short; for, although it undoubtedly induces energetic working, and is in many cases satisfactory, it is often the reverse when it taxes the workman beyond his strength, and when, owing to severe competition, it depresses wages to starvation point, and when it tends to the production of inferior work. And it certainly fails to produce that identity of interest between employer and employed, that is necessary to obtain for both the best results.

Perhaps the most serious difficulties in the way of the general adoption of profit-sharing are—on the part of employers, a disinclination to take the trouble, the fear of the opposition of trades unions, and the hesitation to face the cost in money; and, on the part of workmen, the idea that it is antagonistic to trades unionism. Employers may be told that another strike against it in gas-works is not at all likely; and that the result in improved working, by cheerful and contented workmen, and the friendly relations that ensue, are worth all the trouble and cost. Workmen may be reminded that trades unionism is not another gospel, and is not the be-all and end-all of the workman, but only a means to an end; that its legitimate objects are to obtain just and reasonable conditions of labour, to provide assistance in times of difficulty and old age, and to secure as high rates of pay as the industry can fairly afford. It is only this last-named condition that is affected by profit-sharing, and to the extent in which it accomplishes this object, it so far relieves trades unions of the most difficult part of their work—that part which is by far the most prolific cause of disputes—and leaves them free to pursue their other objects with far greater probability of easy attainment. Unless, however, profit-sharing is not only a just system, but also advantageous to employer and employed, time and trouble would be wasted on its consideration and adoption.

Although, owing to human imperfection, absolute justice in all dealings between man and man is extremely difficult, and probably impossible of attainment in its full perfection, it is undoubtedly the foundation principle of all satisfactory relations; and where there is an honest and sincere desire to do justly, working men are not slow to perceive and appreciate it. Therefore, to be a success, it must be in this spirit that any system of profit-sharing must be entered upon; and this will go a very long way towards ensuring its success. But, in addition to aiming at strict justice, it may and ought to be so worked to the advantage of both employer and employed, as to encourage those cordial and friendly relations which are so much wanted and so necessary to bind class and class together. For instance, one great reason for the workman's indifference is the want of hope with which he works. It is very difficult for a workman to provide (say) during 40 years or more of his working life—as an honest, sober, and industrious man ought to be able to provide—sufficient to enable him to live in comfort and independence in his old age. It is, in truth, very difficult for the average workman to regularly and persistently put by anything out of his weekly wages. To do so requires a combination of qualities that is rare in every class—viz., persevering industry, self-denial, temperance, and thrift. Then, when the workman does save, he has much greater difficulty than other classes in safely investing his savings at (say) 4 or 5 per cent.; and his savings, particularly if uninvested in some permanent security, are very liable to attack by impecunious relatives and questionable friends. Hence one reason for his very common and natural desire to keep his savings secret.

Now, profit-sharing may be so worked as to materially help to meet these difficulties; and it is certainly to the advantage of employers to manifest their friendly interest in the welfare of their workmen, by endeavouring to make it as much to their advantage as possible by giving them opportunities of so saving or investing their annual bonus as to encourage thrift, and to make provision for old age, for which profit-sharing is peculiarly adapted.

The simplest and most generally applicable form of profit-sharing consists in treating the wages received by the workmen as their capital in the business; and after

paying a fixed but moderate rate of interest on the capital proper, dividing any surplus in agreed proportions—giving the workmen a percentage on their wages in the shape of an annual bonus, and giving the capital some additional interest. There must necessarily be modifications to meet the varied circumstances of industrial life; but the principle remains the same—viz., that of giving to both parties an identity of interest in the prosperity of the business in which they are engaged. There will no doubt be difficulties; but "Where there's a will, there's a way."

Profit-sharing as applied to gas companies is simply an extension of the sliding-scale. It was felt, when the South Metropolitan Sliding-Scale Act was passed in 1876, that it would not be complete unless officers and workmen were brought under its operation; and a proposal was made at the time to extend it to the officers. But the Directors declined to entertain the question. It was, however, revived in 1886, in a somewhat crude form, when an annual bonus dependent on profits, was given to the officers and foremen; and in 1889 the necessity of doing something to attach the workmen to the Company, led to its extension in its present form to all the employees.

Why should the workman be denied a reward for improved working, or a share in the prosperity that comes when the price of coal falls or that of products rises? while the consumers and shareholders, who do nothing actively (although both do their part in other ways) to promote the welfare of the undertaking, are well cared for. In truth, the sliding scale is a very halting measure, since the only parties who come under its active influence are the directors and such of the employees as may happen to be shareholders. To obtain the full benefit of the sliding scale, and to make the principle just to all, the partnership which it creates between, and which has been so beneficial to, shareholders and consumers ought to be extended without delay to every official and workman, from the highest to the lowest; and where the sliding scale is not in operation, the necessity for the adoption of the same principle applies with equal force. It only needs some modification to adapt it to the altered conditions.

The circumstances that were the immediate cause of the introduction of the profit-sharing scheme by the South Metropolitan Gas Company were as follows: In 1887, and again in 1888, suggestions had been made to the stokers to adopt the system of eight-hour shifts; but until the men were captured by the Socialists in 1889, these suggestions were not entertained. When, however, they made their demand, in June, 1889, it was at once conceded; and all went well for a short time. But having obtained so much and so easily—for the adoption of the eight-hour system involved a considerable increase of pay—they were constantly demanding further small concessions. As a rule, they obtained them, until at last it became clear that the object of the Union was to become masters of the business; and in the pursuit of that object they endeavoured to coerce every man in the Company's service into their ranks. The control of the retort-houses had entirely passed out of the hands of the management; and it was felt that the rest of the business would follow, unless a very serious effort was made to retain or to win the goodwill and allegiance of the men. Hence the profit-sharing scheme, which was offered to the men at the end of October; heartily approved by representatives of the free men, and as heartily condemned by the officials of the Union. For a few days this opposition was considered fatal; but the free men began to ask why they should be deprived of so good a thing. On the 6th of November, therefore, it was resolved to offer a participation in profits to any man, or any number of men, who would sign an agreement of service with the Company for twelve months. The object of the agreement was to prevent a strike; but there was a proviso that permitted any individual to leave (with the engineer's consent) at any time. Within a fortnight, practically all the free men—nearly 1000 in number—had accepted the proposal; but the Union remained hostile, and forbade any of its members to sign the agreements, although by so doing their membership would not be interfered with. Moreover, there was no compulsion. Men were perfectly free to accept or to reject the agreement and the accompanying profit-sharing. They were told that they could remain in the service of the Company just as before; the only effect of not signing the agreements being that they would have no share in profits. The truth, however, that "no man can serve two masters" came clearly home to the Union leaders, who saw that the profit-sharing was so good a thing for the men (and their members saw it too), that unless they could prevent its acceptance, their power would be gone. But, in spite of this opposition, some of their members signed the agreements; and on the 2nd of December, the refusal of the demand for the "removal" of three of these men at Vauxhall led, on the 4th, to the further demand for the abolition of the profit-sharing scheme, and that all the men (about 1000 in number) who had signed agreements be "removed from the works." Such an unjust demand, the Directors could not and would not entertain; and the next day came the notices which at the end of a week terminated with the great strike of the entire body of 2000 retort-house men. In sympathy with them also, and without notice, all the coal-porters working on the river, and the unionist seamen and firemen that manned the ships, struck.

This was a tolerably heavy price to pay for the profit-sharing scheme; but it was probably the best work ever done, and the most profitable investment ever made by the Company. It not only shook off a most galling tyranny, and gave freedom to both employers and employed, but it resulted in such cordial relations and identity of interest between the parties, as had been before unknown. Moreover, it purchased the right and the power to take all these good things by all other gas undertakings that have the courage to take, and choose to have them. It also arrested the further aggressive action of the Union.

It now only remains to describe the terms of the profit-sharing scheme. Possibly such a system is as difficult to apply to gas undertakings as to any industry, because, unlike other industries which rejoice in high prices for their product, their interest is to sell gas at the lowest practicable price. The profit-sharing, therefore, cannot be simply based on profits. Fortunately, however, there was the principle of the sliding scale; and this principle for this purpose can be adopted quite as easily, and quite as effectively, by non-sliding-scale companies, and by corporations owning gas-works, as by sliding-scale companies. All that is necessary is the arbitrary fixing of a fair initial price; and to agree that for every reduction of 1d. per 1000 cubic feet that is or can be made in the price of gas, all the officers and workmen shall have annually, or at the end of a shorter term of service, a certain percentage on their salaries or wages.

The initial price under the sliding scale of the South Metropolitan Company (fixed by Parliament) is 3s. 6d.; the selling price in 1889 was 2s. 3d. per 1000 cubic feet; and the increase of dividend is at the usual rate of ¼ per cent. for each penny reduction. It was felt that ¼ per cent. per penny would not be enough as a percentage on the men's wages. Consequently, instead of adopting the initial price of 3s. 6d. fixed by the Act, the arbitrary figure of 2s. 8d. was taken; and this could just as well have been done, had the Company not been under the sliding scale. Then, instead of ¼ per cent., 1 per cent. was also arbitrarily taken as the bonus on the salaries or wages of the officers and workmen. The effect of this was, at 2s. 3d., to make the profit-sharing bonus equal to 5 per cent. on the ordinary income of the employees—that is, their day wages. Should the price go down 1d., it would be 6 per cent.; and so on. Should it go up (as unfortunately has been found necessary) to 2s. 6d., the bonus will be reduced to only 2 per cent. This, of course, is a severe trial to the system; but so far it has stood the test. The men are working as cheerfully and well, and their relations with their employers are as good as ever; and there is no reason to doubt that their goodwill and confidence in the Company have been in the slightest degree shaken.

The simple distribution of an annual bonus, however, is not sufficient to ensure the highest benefit that may be made to accrue to the men from the system. In many cases of profit-sharing, a certain proportion—commonly one-half—is compulsorily reserved for future benefit; the men only being allowed to draw the balance. The object undoubtedly is good; but that is all that can be said for the practice. If the workmen have a right to a share of surplus profits, as is emphatically contended in this paper, that share, as soon as earned and declared, ought to be at their free disposal, as is the case with their wages. It is true they may not make the best use of it. But the time is past for treating them as children; and it is best that they should feel and bear the responsibility of the use they may make of their bonus. But the employer, while fully respecting

the freedom of his workmen, can help them most materially and effectively by providing the opportunity for safely and profitably investing their savings.

In connection with the South Metropolitan profit-sharing scheme, the Company undertake the custody of the whole or such portion of the bonus as the men choose to leave in their hands, and of any weekly or other savings they may deposit with them, at 4 per cent. interest; such deposits being quite free to be entirely or partially withdrawn at any time, on giving a week's notice. Moreover, facilities have been given to the workmen to invest their bonus or their savings in the stock of the Company at market prices, which yield rather more than 5 per cent. £5 nominal value is the smallest amount of stock that can be purchased; and already £3035 has been invested, which is being increased almost every week.

The profit-sharing system was started by crediting every man with the amount, called a "nest-egg," he would have received during the three years prior to June, 1889; but this was done for special reasons existent at the time, and is now quite unnecessary. The "nest-egg," amounting to £6863, has, by the voluntary and unanimous determination of the men, been left in the Company's hands, to accumulate at 4 per cent. compound interest until June 30, 1894, when both the "nest-egg" and the interest will be at their free disposal. But all bonuses accrued since the year 1889 have been free as soon as they have been declared. The amount for the year to June, 1890, was £6037, of which, in the course of the succeeding twelve months, the men withdrew £3428—the greater part in the first month. The bonus for the year up to June 30 1891, was £8653, of which £4659 was withdrawn in the first month; the satisfactory balance of £4000 being left in the Company's hands. The total amount of bonus and savings belonging to the workmen on March 31, 1892, in the hands of the Company, was £18,716, in addition to their investments in the stock.

It is not stated, nor was it expected, that all the men in the Company's service would either understand or appreciate, or even be influenced by, the profit-sharing scheme. That must be a work of considerable time, for which patience is needed. But the result has far exceeded the most sanguine expectations of the promoters. Whether or not it is due to the profit-sharing scheme, the fact remains that, in place of hostility and antagonism, there are peace and goodwill; in place of doubt and mistrust, there is confidence (of which the strongest evidence is to be found in the fact that the workmen trust the Company with their savings); in place of sullen looks and conduct, there are friendly smiles and greetings. The Company have a body of cheerful, willing, and capable workmen, such as they wish every gas undertaking in the kingdom possessed. Who will enter upon this inheritance?

NOTES ON OIL-GAS MANUFACTURE.

By A. F. Browne, Rotherhithe.

At the meeting of this Institution held in May last, a paper was read upon "Oil Gas as a Substitute for Cannel," which elicited considerable discussion.

At that time experiments in oil-gas manufacture were being carried on at the Rotherhithe works of the South Metropolitan Gas Company. These were subsequently continued; and the object of this paper is to place the results obtained before the members of this Institution, together with a comparison of the values of oil gas, petroleum vapour, and cannel as enrichers of gas produced from common coal.

The following table gives in column A the various percentages of some enriching gases of high candle power required to raise common gas one candle power (from 16 to 17); and in column B, the quantity in cubic feet of each gas by which it is necessary to augment every 1000 feet in any existing volume to obtain the same percentage composition.

It will be found to cost more per candle to enrich a gas of high illuminating power than one of lower value. The reason is obvious, if it be granted that the candle power of these enriched volumes may be calculated as a mere matter of figures from the mechanical mixture of their component volumes. Thus to raise 16-candle to 17-candle gas by the addition of 40-candle gas, 4·17 per cent. is needed; but to increase 32-candle to 33-candle gas requires 12·5 per cent., or three times as much for the one candle.

To raise Coal Gas from 16 to 17 Candle Power.

Candle Power of Enriching Gas.	A Percentage of Enriching Gas required.	B Quantity in Cub. Ft. to be added to Initial 1000 Cub. Ft.
30	7·14	76·93
35	5·26	55·55
38	4·54	47·63
40	4·17	43·48
45	3·45	35·71
50	2·941	30·30
55	2·564	26·31
60	2·272	23·25

Note.—The above table has been calculated from the formulæ—

$$A \frac{IP_1 \sim I P_3}{I P_1 \sim I P_2} \qquad B \frac{I P_1 \sim I P_3}{I P_2 \sim I P_3}$$

in which I P_1 is the initial candle power of the gas to be enriched, or reduced; I P_2 the candle power of the enricher, or reducer; and I P_3 the candle power desired.

Oil Gas.

The apparatus in use at Rotherhithe for the manufacture of oil gas was improved and extended, subsequent to the last meeting of this Institution, by the addition of an exhauster, a meter, a small purifier, and a gasholder of about 100 cubic feet capacity.

The experiments were made with a setting of four iron retorts, each formed of two 12 feet lengths of 12-inch main-pipe set in a bed 20 feet through, with their ends projecting some 2 feet from the face of the brickwork. The oil was stored in an elevated tank, from which it was led into one end of the retort through an ordinary lantern cock and syphon; a slope of brickwork being built within the mouthpiece, upon which a small shoot, 3 feet long, was laid to carry the oil forward. A 5-inch ascension-pipe was fixed at the opposite end of the retort. The bed was heated by a furnace placed at each end. The gas passed from the retorts into a dry receiving main, thence through a seal formed in the 6-inch pipe, which conveyed it to the exhauster; the pipe being about 100 yards long, and having three syphons in its length. Syphons were also placed between the dry receiving chamber and the seal, and between the exhauster and the meter; so that it will be apparent that condensation of the oil has been an anticipated feature of the process of converting it into gas. Experiments have confirmed the opinion that comparatively low temperatures are essential to the production of very rich oil gas. The choice appears to lie between low makes of high illuminating value attended with considerable condensation of oil, and greater quantities of much lower value accompanied by deposition of lamp-black and stopped pipes.

The following table summarizes the results on which these statements are based.

Candle Power of Oil Gas.	Cubic Feet per Gallon. Average.	Highest Yield in Cubic Feet.	Lowest Yield in Cubic Feet.	Condensation per Cent. Average in Gallons.	Rate per Retort per Hour. Average.
35	83	83	—	8·5	unknown
40	60	93	44	10·5	4·25
45	67	81	52	15·0	3·5
50	60	76	52	14·5	3·5
55 and upwards	60	65	54	16·0	3·0

The oils experimented upon were Russian refined, specific gravity ·825, net price delivered 4d. per gallon; and Scotch oil, specific gravity ·845, net price delivered about 5¼d. per gallon. The experiments were all conducted with the view of making as rich a gas as possible. Gases not only well over 50, but of from 55 to 60 candle power were obtained; and it is certainly safe to say that at proper temperatures, despite heavy condensation, a gallon of Russian or Scotch oil will yield 50 cubic feet of 50-candle gas calculated upon the gross quantities passed through the retorts. There has now to be considered the question at what price per 1000 cubic feet this gas can be put into the holder, as compared with 1s. (the cost at Rotherhithe, into the holder, of common gas, including first cost of coal, carbonizing wages, repairs, and purifying, less residuals).

A gallon of Russian oil, delivered in casks in London, costs 4d. net (this price can be reduced to 3¼d. when the oil is delivered in tank-lighter alongside the wharf). At a production of 50 cubic feet per gallon, 20 gallons are required per 1000 cubic feet, costing 6s. 8d. To this must be added, unloading 3d., together with retort-house and purifying charges, which will not exceed 3d.—say 7s. 2d. per 1000 cubic feet. Now to raise gas from 16 candles to 17 candles, by the addition of 50-candle gas, requires,

according to the table already given, 2·94 per cent. Therefore the cost of 1000 cubic feet of gas so enriched will be—

2·94 per cent. at 86d.	2·52d.
97·06 per cent. at 12d.	11·65
	14·17d.

Say, 2·2d. net per 1000 cubic feet for the additional candle in Russian oil, as against 1s. per 1000 cubic feet before enrichment.

Before proceeding to the comparison of the foregoing conclusion with the results of other methods of enrichment, it may be desirable to make some comments upon the stability and comparative purity of 50-candle gas obtained from the particular oils used in these experiments. It has not been found that further condensation takes place after the gas has passed the wet meter. Many of the illuminating power results have been obtained from gas previously stored over water for 18 hours without any diminution of volume; and the richest sample made was found to have suffered no deterioration after upwards of 60 hours' storeage over water. The gas may, therefore, be considered to be of a sufficiently permanent character. As regards comparative purity, it has been found that the quantity of sulphuretted hydrogen in the gas is very small, but enough to render it necessary to pass the gas through a purifier. Its purification by lime and oxide has not been found to injure the illuminating power of the gas. Carbonic acid and sulphur compounds, other than sulphuretted hydrogen, are present in such trifling quantities that they may safely be disregarded, and there is no trace of ammonia.

The tests for illuminating power were all made with the sperm candle, and no attempt has been made to determine the illuminants present by chemical methods; neither has the specific gravity of the gas been as yet investigated.

This last is a question of great importance in connection with its use as an enricher. Gases of different gravities and candle powers cannot be properly mixed in the gasholder, because the process of diffusion takes time. The gases must, under ordinary conditions of supply, be mixed whilst in motion; and, other things being equal, the farther they travel together the better—although, whether for the attainment of a result purely mechanical it is necessary to pass a very rich and nearly pure oil gas through the hydraulic mains, condensers, washers, and scrubbers used in the manufacture of coal gas, is a question which still remains to be settled. Certain mixtures of coal and oil gases have been made in the 100 cubic feet holder referred to. These were percentage mixtures, upon the lines of column A. In each case the oil gas was passed in first, and the coal gas immediately afterwards. This plan appeared to mix the gases thoroughly, since the resultant illuminating values were very fairly in agreement with theory.

To revert to the question of cost, How does this compare with enrichment by gas made from cannel coal? It is found, at Rotherhithe, that to raise the quality of common gas from 16 to 17 candles, 100 tons of the coal to be carbonized must contain not less than 7 per cent. of the particular cannel used there, which increases the cost per ton carbonized by 2s. 4d. And, calculating that the yield of gas is raised by 175 cubic feet per ton, the cost per 1000 cubic feet into the holder is increased from 1s. to 14·6d.

It now remains to compare with the two foregoing methods of enriching, the cost of obtaining a similar increase in illuminating power, by means of petroleum vapour, which plan has been in daily operation at Rotherhithe for some months.

It is unnecessary to do more than state briefly that the apparatus consists of a vaporizer, which has a top and bottom chamber connected by numerous tubes, surrounded by steam. The oil is pumped into the bottom chamber; rising through the tubes, it is vaporized; and the vapour is delivered at the top—passing thence direct to the mains under induced current, due to the action of an injector. The apparatus is an admirable one, speedy in operation, and most efficient. The petroleum used is of ·680 specific gravity; and the present price, delivered in London, is 8·75d. per gallon net, to which must be added 0·15d. to cover cost of unloading, fuel, and attendance—making the total cost at Rotherhithe 8·9d. per gallon.

From daily experience, corroborated by special tests made for the purposes of this paper, it is found that 0·25 of a gallon is required per 1000 cubic feet (2·5 gallons per ton of coal) to increase 16-candle gas by 1 candle. The cost per 1000 cubic feet is, therefore, 8·9d. × 0·25d. = 2·22d., from which must be deducted the sale value of the vapour at the price into the holder of an equal volume of coal gas. It has been stated that 1 gallon of ·680 petroleum yields 100 cubic feet of vapour. If this is reliable, then 100 × 0·25 = 25 feet at 1s. per 1000 to be deducted = 0·3d. The cost, therefore, into the holder at Rotherhithe of 1000 cubic feet of common gas, enriched from 16 to 17 candles, is as follows:—

If enriched by petroleum vapour	13·92d.
„ „ oil gas	14·17
„ „ cannel gas.	14·60

as against 1s., the cost of common gas.

It appears from this comparison that oil provides the gas maker with a means of enriching coal gas at a cost which will, even with a production of only 50 cubic feet of 50-candle gas per gallon, contrast favourably with cannel, and compete very closely with ·680 petroleum at 8·75d. per gallon.

It may, therefore, be of interest to offer some further remarks upon the process of the gasification of oil or petroleum. The outlook is encouraging, not only from the apparent quantity of oil available, but from the fact that it seems unlikely that petroleums of specific gravity above ·800 will advance in price. There can be little doubt, therefore, from the interest that is already taken in the subject (which has received such impetus from the work of Professor Lewes), that it will meet with considerable attention from gas makers in the near future. The end in view is the production of the greatest attainable quantity per gallon of gas of 50-candle power and upwards, with the least condensation of oil, and upon the smallest floor space.

From information already available, it seems probable that 75 cubic feet per gallon of 50-candle gas must be considered the irreducible minimum of good working; this, upon the authority of Mr. Botley, being the average return from a series of oils. This standard result is presumably to be attained by the determination of the proper temperature for gasifying any oil which may be suitable for the purpose of enrichment, and the discovery of the necessary retort surface per gallon of oil dealt with per hour.

As regards temperature, Mr. Foulis, in his paper read before this Institution last May, calls it "a bright red." A *résumé* of the Pintsch process appearing in the JOURNAL OF GAS LIGHTING of April 21, 1891, speaks of "a full cherry-red retort;" and a pyrometer in use at Rotherhithe indicates 1400° to 1600° (say, 1500°) Fahr. as most suitable for the gasification of Russian refined oil. These statements are fairly concordant.

There also appears to be a rough-and-ready means of determining whether a retort is hot enough for the quantity of oil passing through it—viz., the appearance of the crude gas. This, if the temperature is too low, is white; if too high, is dark; and if right, a pale straw-colour, which latter, probably, indicates that the gas is just upon the point of throwing down solid carbon, and would not bear any increase of temperature without doing so. But, with regard to retort surface per gallon of oil per hour, there is disagreement. Thus, the Pintsch process employs a pair of 10-inch Ω-shaped iron retorts, each 6 feet long, to gasify 5 gallons (36 square feet = 7·25 square feet per gallon). This twin retort produces 450 cubic feet of 40-candle gas per hour, or 10,800 cubic feet per twenty-four hours from Scotch shale oil, specific gravity ·860 to ·875. Mr. Foulis has passed 4 gallons of oil per hour (shale oil, specific gravity ·850) through a retort, 18 inches by 13 inches by 9 feet long (39 square feet = 9·75 square feet per gallon), producing slightly over 300 cubic feet per hour, of 62 to 66 candle gas, or about 7500 cubic feet per retort per twenty-four hours. It was not stated whether this retort was of iron or fire-clay. At Rotherhithe, the rate for the richest gases has been about 3·5 gallons per hour, through a 12-inch circular iron retort, 20 feet long (surface 63 square feet = 18 square feet per gallon), say, 266 feet per hour. Here nothing appears to be gained from the increased surface; and from the point of view of economy of space, the comparison with the work done by the Pintsch retort and that of Mr. Foulis is very unfavourable.

It appears, therefore, that the dimensions and material of the retort best suited for the gasification of 4 to 5 gallons of oil per hour, at a temperature of about 1500° Fahr., and producing 300 to 450 cubic feet per hour, or about 7500 to 10,000 cubic feet in twenty-four hours, have yet to be agreed upon. In this connection it may be remarked that the process being continuous, there is no period of recuperation

in which the retort may regain its temperature, as when charged with coal. Hence, if regular heats are to be maintained, the firing should also be a continuous process; and therefore the employment of gas-producers is desirable. There appears, however, no reason why 4 to 5 gallons per hour should be looked upon as the ideal rate. It will probably be found more economical to adopt some form of chamber or flue of large surface, as suggested by Mr. Foulis, the gasifying power of which might easily be 12 gallons of oil per hour. It also seems desirable that the point where the oil enters should be comparatively cool, so that it may be slowly vaporized, and then gasified and fixed. At Rotherhithe, the retort is kept at a temperature of about 500° at the end where the oil is run in; and the first length of the twin-retort of the Pintsch process would appear to be worked at a lower temperature than the second.

[ADDENDUM.]

The following addition to the paper, as submitted, was made by permission:—

The foregoing oil-gas experiments were made last autumn; and as the plant was too small to produce gas enough to have any appreciable effect upon the bulk of the winter's make, they were discontinued. Upon reconsidering the matter in connection with this meeting, it seemed necessary to attempt something on a working scale. Accordingly, the makeshift iron retorts were taken out; and an ordinary setting of seven clay retorts 21 in. by 15 in. oval, and 20 feet long, was substituted. It was hoped that each retort would prove capable of gasifying at least 10 gallons of oil per hour. The joints of the retorts and mouthpieces were very carefully made; two larger purifiers were provided; and the delivery-pipe was attached to one of the station meters, in anticipation of a large make. These retorts are set in the ordinary manner, and are thus available for oil or coal. Facilities exist for taking gas from either mouthpiece, or from both at once. The setting was not ready until after the date when the paper now in your hands had been sent in. These retorts were heated, like the iron ones, to about 1500° Fahr. at one end; but at the end where the oil was run in they were not coloured. The results obtained were very disappointing, not as regards illuminating power, which was from 40 to 50 candles, but in the yield of gas per gallon. This was greatly reduced; and it was soon discovered that the oil ran through the retorts, and was burned in the furnace. It was at once apparent that if clay retorts were to be employed, the dull end or zone of low temperature must be dispensed with, as the retort would never become sound until highly heated. It was known to be destructive to the gas to pass it through 20 feet of a retort to 1500° Fahrenheit; therefore, while each end was equally heated, the gas was allowed to flow away by the ascension-pipe at that end of the retort at which the oil entered—thus ensuring short contact at the high temperature.

The illuminating power proved to be equally good, if not better, and the yield per gallon was greater, though still considerably below that obtained from iron retorts; and it was again found that oil was leaking into the furnace. This seemed to prove that it will not do to run oil in a constant stream into clay retorts; and a return was therefore made to the plan of intermittent injection under pressure, by which the oil is sprayed, as recommended by Mr. Good, of Carshalton. An experiment made upon these lines gave a result of 80 cubic feet of gas, of not more than 30-candle power—the oil being injected at the rate of 5 gallons per retort per hour; in all, 35 gallons. This was all that two men could inject in the time, though the retorts were apparently capable of gasifying twice as much at each end. It must be admitted that the retorts were too hot; showing a temperature beyond the range of the pyrometer, which was probably not less than 1800° Fahr. —lamp black being deposited. This plan would appear to promise the best results from clay retorts; but it costs too much for labour.

To sum up this latter portion of the paper: The system of feeding oil into retorts by gravitation in a constant stream seems to be unsuitable for clay retorts. If these are to be employed, the method of injection under pressure should be resorted to; but this should be brought about by some mechanical means other than a hand-pump. Gravitation—at once the simplest and cheapest method of feeding the oil—may be employed in conjunction with iron retorts, when it will probably be found advisable to keep the retorts at a low temperature at the point where the oil enters.

THE USE OF OIL FOR CARBURETTING GAS.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich.

During the past few years the gas managers of this country have gradually been accustoming their minds to the search for promising sources of enrichment for coal gas, in order to prepare for the not far-distant day when cannel will have to be replaced by some other carburetter.

First and foremost amongst the materials likely to be utilized for this purpose, stand the various grades of oils popularly known as petroleum and paraffin; and the object of this paper is to bring before you the results of a long series of experiments made with the view of ascertaining how far we may rely upon oil as a means of enrichment for coal gas of poor illuminating power.

The main points which it is important the gas manager should have in view, in forming a judgment upon the probable future of oil as a carburetting material, are—

I. The grades of oil from which to obtain the best results.
II. The methods by which the greatest illuminating value can be obtained from various oils.
III. The relation between the cost of the various grades of oil and the results which can be obtained from them.

In attempting to solve questions of this description, it is important that, if the results are to be of any value for the purpose of comparison, the determinations should all be made under as nearly as possible the same conditions and by the same observer; and that the greatest attention should be paid to the determination of illuminating value.

My own views on the subject of photometry are that, before any accurate determination can be made, the rate of flow and size of burner used must be fixed to suit the physical peculiarities of the gas to be tested. With a gas of under 18-candle power, and with a specific gravity of about that of ordinary coal gas, the standard Argand gives the best test results; whilst, as is well known, with illuminating values above 25-candle power, a flat-flame burner must be used—the size of the burner decreasing as the gravity and illuminating value of the gas increase.

In the following experiments, the "London" Argand has been used as the burner for all gases from 9 to 18 candle power; the flame being kept 3 inches in height. From 18 to 25 candle power, both Argand and flat-flame burners were employed. Above 25-candle power, selected Bray burners were used; the flow of gas and size of burner being regulated to give the best obtainable flame, and the rate of flow being accurately noted, the results were calculated to 5 cubic feet per hour. In all cases standard sperm candles were used; and the determinations were made in an Evans-Sugg photometer, with all the usual precautions and corrections. All candle powers given are the mean of three sets of ten readings. The first experiments were to determine the relative values of oils which could be obtained in such quantities, and at such prices, as would render them commercially possible to use for the production of oil gas; and also to find the most favourable temperature of "cracking," to yield the highest results. The retort employed was of iron, 1 ft. 10 in. long, and 4 inches in diameter; the tube by which the oil was fed in, passing from the front to within an inch of the back of the retort; whilst to keep the temperature as nearly as possible the same throughout, the retort was loosely packed with coarse iron turnings.

The oils employed were—

I. Russian "distillate" oil, having a specific gravity of ·864, and a flashing-point—open, 149° Fahr.; closed, 135° Fahr. This is the same oil as that employed on a large scale at Beckton for carburetting the water gas made by the improved Lowe process.
II. Crude Russian oil, having a specific gravity of ·866, and a flashing-point—closed, 55° Fahr.; open, 59° Fahr.
III. Intermediate shale oil, having a specific gravity of ·868, and flashing-points above 250° Fahr.

IV. Green oil of a specific gravity of ·848, and a flashing-point over 150° Fahr.

V. Blast-furnace oils of a specific gravity of ·848, and a flashing-point of 221° Fahr.

I.—*Russian Distillate Oil.*

Temperature of Cracking.	Yield of Gas per Gallon.	Percentage of Residuals.	Candle Power per 5 Cubic Feet.	Candles per Gallon of Oil.	Grains of Sperm per Gallon of Oil.
	Cub. Ft.				
Incipient red*	12	59·1	54·8	131·52	15,782·4
Medium red†	60	22·7	50·7	608·40	73,008·0
Full red‡	84	11·8	42·2	708·96	85,075·2

II.—*Crude Russian Oil.*

Incipient red*	20	44·3	6·6	226·50	27,180·0
Medium red†	56	17·6	48·4	542·08	65,049·6
Full red‡	80	8·8	47·2	755·20	88,624·0

III.—*Intermediate Shale Oil.*

Incipient red*	8	81·8	44·8	71·88	8,625·6
Medium red†	48	20·9	56·1	538·56	64,627·2
Full red‡	80	15·4	42·0	672·00	80,640·0

IV.—*Green Oil.*

Incipient red*	16	18·1	61·1	195·20	23,424·0
Medium red†	48	22·6	59·2	568·32	68,198·4
Full red‡	70	33·3	50·1	701·40	84,168·0

V.—*Blast-Furnace Oil.*

Incipient red*	12	72·7	40·2	96·48	11,577·6
Medium red†	56	54·1	25·6	286·72	34,406·4
Full red‡	68	36·3	22·9	316·44	37,972·8

* 977° Fahr. † 1292° Fahr. ‡ 1652° Fahr.

These results, having been obtained under exactly similar conditions, may be taken as being strictly comparative; although they do not represent the highest possible results obtainable. They show that the Russian oils are the best for carburetting; and that a full red is by far the best temperature at which to crack them. Other experiments show that, if the temperature of cracking is pushed beyond this point, the increase in yield of gas is considerable; but the fall in illuminating value is so rapid that no advantage is gained. Next to the Russian oils, and but little inferior to them, come the intermediate and green oils; whilst for cracking in this way, the blast-furnace oils are practically useless.

We have now to consider how oil can best be converted into a permanent gas, so as to yield the highest possible illuminating value per gallon of oil used; as it by no means follows that the simple retorting of the oil is the best method to employ.

The first step in this direction was to try and ascertain if cracking the oils in contact with a large surface of carbonaceous material in any way tended to increase the illuminating value of the gas; as it was quite conceivable that the surface-action of a mass of red-hot coke or charcoal might influence the chemical changes taking place during the conversion of the oil into a permanent gas.

In order to do this, two tube retorts 4 ft. 6 in. long and 2 inches in diameter, with an oil-tube passing down the centre and delivering at the closed end, were arranged side by side in the same furnace, so as to ensure equal heating. One of these retorts was packed with small pieces of coke, the size of big peas; while the other was left empty—the gas from each retort being led separately through a depositing tube and washer to a gasholder, where it was collected, and afterwards tested. In all cases the temperature employed was a bright red heat.

The first thing that strikes one in these results is that the use of a long narrow retort has caused a distinct improvement in the quantity, and also illuminating value, of the gas, as compared with that obtained by using a short broad retort; and it has brought into striking prominence the superiority of the two Russian oils over the shale oils for gas-making purposes. The experiments also show that the presence of the carbonaceous surface during cracking, although it slightly increases the luminosity, does so to so small an extent that it would be hardly worth while to incur the extra risk of choking in the apparatus by using it.

Oil Used.	Without Carbon.		With Carbon.	
	Cub. Ft. of Gas per Gal.	Illum. Power.	Cub. Ft. of Gas per Gal.	Illum. Power.
"Distillate" oil	92	46·00	92	47·13
Intermediate shale oil	60	52·00	56	55·20
Green oil	68	59·00	64	58·80
Crude Russian oil	92	50·10	92	52·30
Blast-furnace oil	52	28·40	52	34·30

In the case of the blast-furnace oils, the increase is much more marked—amounting to no less than 20 per cent., which is due to the fact that these oils contain a certain quantity of phenol, which is converted into benzene by passage over the red-hot carbon.

So far, the experiments have shown that, amongst the oils the price of which renders them available for gasifying, the Russian oils are the best; and we have also seen that very little is to be gained with these oils by using carbon in the chamber in which the cracking takes place, whilst a long narrow retort gives better results than a short broad one.

The next point to determine is whether the illuminating value of the oil gas can be still further increased; in other words, if a higher illuminating value per gallon of oil can be obtained by any other process.

The petroleum oils are all mixtures of highly complex hydrocarbons, which are liquid at ordinary temperatures; and on retorting these oils, the heat first volatilizes them, and then causes a breaking down of their molecules, with the result that simpler hydrocarbons, gaseous at ordinary temperatures, are formed, whilst liquid hydrocarbons of far lower boiling point than any existing in the original oil, are to be found in the tarry residue. Of the gaseous hydrocarbons so obtained, some belong to the saturated or paraffin group; and the higher members—such as ethane, butane, propane, &c.—have a high illuminating value; while still more valuable in this respect are the unsaturated hydrocarbons, of which ethylene, benzene, toluene, and crotonylene are the most abundant in the gas. These hydrocarbons have all been formed from more complex ones by the action of heat; and after their formation, an increase of temperature continues the breaking-down action, and gives rise to marsh gas, which is of little illuminating value, and finally of carbon and hydrogen—the former being deposited, while the latter has no light-giving power.

The range of temperature within which the oil can be decomposed so as to give the largest possible volume of the hydrocarbons valuable for illumination is very narrow; and the wall of a retort is always far hotter than the gas near the centre of the retort. The result of this is that from the central portion some of the oil vapours escape "uncracked," and deposit from the gas on cooling; while the vapour in contact with the wall of the retort gets overheated, deposits coke and pitchy matter, which tends to choke the exit-pipes, and yields a certain proportion of gas of low illuminating value, so that with the ordinary forms of oil-gas retorts, the full illuminating value obtainable from the oil is never reached.

This loss might to a great extent be overcome on a small scale by altering the form of retorts, and by a very careful regulation of the temperature; but on a large scale this would not be possible.

On a manufacturing scale better results may be obtained by "cracking" the oil vapours in an inert gas, such as hydrogen, carbon-monoxide, or water gas, which by separating and partly protecting the molecules during their decomposition by heat, increase the range of temperature within which the best results can be obtained, and prevent excessive breaking down of the hydrocarbons and consequent loss of illuminating value. That this is the case, is shown by the following experiment: A known volume of coal gas was taken and passed through a porcelain tube packed with broken pieces of the same material, and heated to bright redness. A copious deposition of carbon was the result; and the gas after cooling burnt with an almost non-luminous flame. The same volume of coal gas was now diluted with twice its volume of hydrogen, and was passed at the same rate of flow as before through the tube heated to the same temperature, and only 1-200th of the amount of carbon previously thrown down was deposited.

Ample verification of this interesting and important fact can be obtained from the data collected in carburetting water gas by several of the best known systems, in which the oil vapours are carried by the hot water gas through heated chambers, in which the decomposition of the oil to permanent gases is effected, and yields results which could not be approached by making the oil gas and water gas separately and afterwards mixing the two.

Take, for instance, the Russian "distillate" oil. The best results obtained by cracking it by itself were 92 cubic feet of 46-candle power gas per gallon, which is equal to 846·4 candles per gallon; whilst the same oil, when cracked in a current of water gas in the improved Lowe apparatus at Beckton, yields (according to the figures given by Mr. Goulden in his paper read before this Institution in May last) no less than 1200 candles per gallon, or an increase of nearly 42 per cent.

The working from which Mr. Goulden quotes these results, however, was on a very large scale, and under the best conditions; and in order to obtain comparative results, it was necessary to contrast the results obtained by cracking the oil alone, and also in the presence of an inert gas, under precisely similar conditions.

For this purpose, oil was cracked alone in a short experimental retort and collected; whilst after a time, the rate of flow of oil and temperature being kept constant, a slow current of hydrogen was allowed to flow, in known quantity, through the retort, and the resulting mixture of gases collected in a separate gasholder.

The results so obtained were—

Distillate oil cracked alone yielded per gallon 84 cubic feet of 42·2-candle power gas = 709 candles;
Distillate oil cracked in an atmosphere of inert gas yielded 92 cubic feet of 53·8-candle power gas = 989·9 candles;

or an increase of over 27 per cent.

The results quoted in this paper were all obtained with the view of getting strictly comparative figures; and they must not be taken as representing the highest obtainable results. Working on a large scale with the Russian distillate and intermediate oils, 76 to 80 cubic feet of 50 to 60 candle power gas was about the usual result; and this may be accepted as the normal yield, more especially as the figures obtained in continuous working under the best systems in use confirm them.

We have now to consider the question of cost, in order to form an opinion as to whether a poor coal gas can be economically enriched by ordinary oil gas.

With regard to the cost of the oils experimented with, the Russian oils can be delivered in bulk at almost any English port at 3d. to 3¼d. per gallon; whilst the intermediate and green oils can at present be bought in the neighbourhood of Glasgow at 3¼d. to 3⅜d. per gallon. The cost, therefore, of oil as an enricher will vary according to the distance of the works from the nearest sea-port, and the facilities for carriage.

Taking the price of the Russian "distillate" oil at 4d., which would be the cost at the majority of works, we can calculate the cost of the gas from the following data: Using three retorts, 25 gallons of oil yielded 2300 cubic feet of 55-candle power gas* in 7½ hours, with an expenditure of 7 cwt. of fuel; but the man who attended to the retorts could equally well have taken charge of twenty instead of three.

	s.	d.
25 gallons of oil, at 4d.	8	4
Fuel	2	6
Labour	1	2
Charge on plant, &c.	0	1
	12	1

or 5s. 3d. per 1000 cubic feet of 55-candle power gas.

Taking this in candle units, the cost of the oil gas is 1·21d. per candle; but it would more often work out to five farthings. We can now compare these results with the figures obtained by Mr. A. G. Glasgow with the same oil at Beckton, in the improved Lowe water-gas plant, which are 1s. 6d. per 1000 feet for 24-candle power gas, or at the rate of 0·75d. per candle unit.

These experiments and figures seem to clearly show that no method of retorting oil alone, even under the best conditions, can compete with processes such as most of those in use at the present time in America, in which the oil is cracked in an inert gas, at the expense of the waste heat from the water-gas generator. We can now, therefore, answer the questions with which this paper was commenced, as follows:—

I. Russian petroleum is the oil best adapted for carburetting.
II. The best results are obtained by decomposing it in the presence of an inert combustible diluent.
III. The cost of carburetting by such material would be ¾d. per candle unit.

* A very high result.

NOTES ON THE ENRICHMENT OF COAL GAS WITH LIQUID HYDROCARBON.

By T. S. Lacey, Pimlico.

The author had not intended to read a paper before the Institution this session; but, in view of the importance of the subject to all gas engineers, he ventures to place before the members the results of his experience, chiefly with the object of eliciting the opinions of others interested in the question. It is to be regretted that the time available for making the experiments necessary to elucidate many points of importance and interest did not permit their exhaustive investigation; and it is, therefore, quite possible that some of the results obtained might be somewhat modified by more complete and prolonged examination. Although this paper has been written chiefly in relation to the use of carburine in the Clark-Maxim process, yet as the author has had occasion to make some trials of the use of various oils by destructive distillation in iron retorts, and as the results obtained may be of some interest to the members, he proposes to briefly describe them also.

During the winter of 1890-91, pending the completion of the carburetted water-gas plant at Beckton, a large quantity of oil was used as a substitute for cannel. Two methods were adopted—the first, by allowing the oil to run through a 2-inch pipe to the centre of a 20-feet clay retort, it being partially vaporized before leaving the pipe, and fixed by contact with the sides of the retort; the other, by mixing the oil (which was refined petroleum ·823 gravity) with the coal before charging in the usual manner. The latter process was used for an emergency, but without the intention of adopting it permanently.

The first plan had the advantage of being more under control, and was easily applied. About 8 gallons per hour could be used for each 20-feet retort, making approximately 640 feet of gas, the illuminating power of which was not determined.

The author was instructed by his Directors to make some experiments to determine the results likely to be obtained when using oil in this manner; and as clay retorts were not available, a setting of three iron retorts of Ω section, 14 inches by 12 inches by 8 feet, was used—the oil being run in to the back of the retort by a 2-inch pipe, as in the clay retorts. One gallon per hour per retort was found to be the most suitable quantity; the heats being regulated so as to avoid, as far as possible, the formation of soot or oils. The figures obtained are given in the accompanying table.

Table A.—*Refined Petroleum* (**A**) *and Solar Distillate* (**B**), *Tested in Iron Retorts.*

—	Specific Gravity at 60° Fahr.	Number of Gallons to 1 Ton.	Gas Made per Gallon. Cub. Ft.	Illuminating Power. Candles.	Candles per Gallon.	Pounds of Sperm per Gallon.	Percentage by Volume of Tar.
A	·823	272	101·0	31·4	634	10·86	13*
B	·859	261	103·4	33·3	688	11·79	21

* Oil run in by gravity.

The figures were certainly disappointing; but there did not appear to be any reason why the results should be worse than those obtained in clay retorts, and until quantitative determinations have been made when using the latter, it does not appear to be reasonable to conclude that better figures would be attained. Experiments were then made, using superheated steam to inject the oil; a 4-inch pipe being substituted for the 2-inch, and the retort and pipe packed with loose pieces of scrap iron. Various sized jets were used; the one ultimately adopted giving 1¼ gallons of condensed water per gallon of oil. The figures obtained from the solar distillate are given in Table B [next page]. Seventy feet of gas, giving 75-candle power with Sugg's illuminating-power meter, have been made on some

occasions. The difference in the results obtained under various conditions is certainly remarkable.

TABLE B.—*Solar Distillate Injected with Superheated Steam.*

Gas Made per Gallon. Cub. Ft.	Illuminating Power. Candles.	Candles per Gallon.	Pounds of Sperm per Gallon.
82	58	951	16·30*

* Retort packed with scrap.

The process of enrichment with the Clark-Maxim carburetter has been largely used both by The Gaslight and Coke Company and the South Metropolitan Company; the former having applied it at Bromley, where it is used on the inlet of the meters, and at the Pimlico cannel station and Horseferry Road gasholder station, both of which are under the charge of the author. In these cases it is fixed at the outlet of gasholders. In these machines, the spirit is evaporated by means of a steam jacket under pressure, which is utilized by a jet to create a current in a bye-pass main, so that a part of the gas is raised to a high illuminating power, then forced into the main stream, and thoroughly mixed with the bulk. The oil is stored in steel tanks, 5 feet diameter, 8 ft. 6 in. deep, containing 1000 gallons, which are completely enveloped in 6 inches of puddle, and sunk in the ground in brick tanks. The filling and suction pipes are carried nearly to the bottom of the tank, which is ventilated by a ½-inch iron pipe, carried 30 feet up an adjoining gasholder column. Each tank is fitted with a float guided by rods and carrying a ⅜-inch tube working through a gland in the crown. When not in use for taking the depth of liquid, the float is pushed down to the bottom of the tank, and a plug screwed into the gland; the only opening to the tank then being the outlet of the ventilating-pipe, which is removed from all source of danger from lights. The carburetter is charged by a small steam-pump, which is also used to empty the barrels. The amount of vapour mixed with the gas is governed by a regulating-valve attached to the injector, and can be adjusted to any quantity required.

The rapidity and certainty with which the illuminating power of the gas can be controlled are very strong recommendations. The cost per gallon of oil is easily arrived at, as the wear and tear are practically *nil;* and the only labour required is the cost of the attendant employed while carburetting and filling the storeage tanks. The oil used is delivered at the works as required at 9d. per gallon, and is known as "carburine." Small quantities of spirit known as "gasoline" have also been used, at a cost of 1s. 2d. per gallon. The results of the distillation of each of these is given; a long-necked flask being used, and the thermometer placed close to the outlet tube in the current of vapour.

TABLE C.—*Results of Distillations of Carburine and Gasoline.*

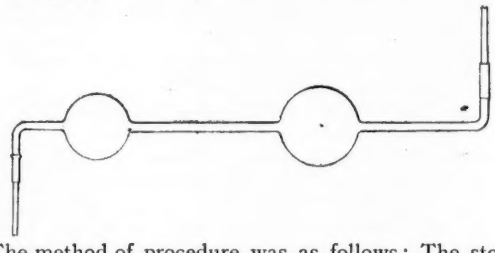
Total Percentage of Original Volume Distilled over.	Highest Temperature Registered in Deg. Fahr.		Total Percentage of Original Volume Distilled over.	Highest Temperature Registered in Deg. Fahr.	
	Carburine.	Gasoline.		Carburine.	Gasoline.
10	138	96	70	176	131
20	143	102	80	188	144
30	150	107	90	206	165
40	155	112	95	220	over 165
50	162	119	100	over	lost
60	170	123		220	

Specific gravity of carburine at 60° Fahr., ·681.
Co-efficient of expansion, ·00048.
Specific gravity of gasoline at 60° Fahr., ·647.

The distillate was measured, and each 10 per cent. by volume distilled over the temperature was noted. The temperature rose continuously; and no sign of any pause could be observed. The oils have since been distilled, using Glynsky's fractionating bulbs, but without any more marked signs of substances boiling at definite temperatures. The author, therefore, concludes they are composed of a number of bodies with slight differences in boiling-points. When shaken with strong sulphuric acid, the oils remained unacted on, only a slight coloration of the acid resulting. The quantity of carburine required to raise gas of about 20-candle power about 3 candles has been tried at various times; the results varying from 1·75 to 2·25 gallons per candle per 10,000 feet of gas enriched. A recent test on 463,000 feet, extending over four hours, took 208 gallons of carburine to enrich gas from 20·38 to 22·96 candles; being equal to an increase of 2·58 candles, and the oil used 1·74 gallons per 10,000 feet of gas raised one candle. The gas was tested with the "London" standard cannel burner at 5 feet per hour; five determinations being made of the gas on the inlet and outlet of the carburetter.

In order to test the value of this material when applied to gases of lower illuminating power, and the effect of using varying amounts of the enricher, recourse to laboratory experiments had to be made. While recognizing that caution is necessary in accepting figures obtained in this way, when they are supported by internal evidence, and are not contrary to experience obtained on a larger scale, they are always worthy of careful consideration.

A great difficulty was experienced in reproducing the carburetter. The following arrangement was adopted after trying several plans: Two hard glass bulbs, one of 60 septems, the other of 30 septems capacity, when half filled, were joined by a tube ⅛ inch in diameter, leaving 4 inches between the bulbs. The tube was continued on the other side of the larger bulb, and bent to a right angle 2 inches from the bulb. The smaller bulb was fitted with a tube with thick walls tapering to $\frac{1}{20}$ of an inch, and bent at right angles in the opposite direction; the bend being 1 inch from the bulb. This tube was passed through a short pipe into the top of a 10-feet test gasholder, so that the point passed through the crown ½ inch. A piece of india-rubber tubing was placed over the end of the open tube looking upwards; and a stopper formed of a piece of small-bore tubing closed at one end, containing a pellet of mercury, was used as a stopper. It also acted as a pressure-gauge.



The method of procedure was as follows: The stopper being removed, the point of a pipette containing the liquid was inserted in the rubber tube, the liquid blown into the large bulb, and the stopper replaced. The volume of gas was then noted, the second bulb heated by an air-burner, and kept hot during the experiment. Another burner was placed under the bulb containing the liquid, which was boiled quickly, so as to give a pressure of 2 or 3 lbs. to the square inch. The difficulty of the condensation of the vapour was thus avoided; and the force with which it entered the holder secured thorough mixture.

A considerable expansion of the gas in the holder, due to the heat of the vapour, might have been expected; but, as a matter of fact, no alteration in the bulk, except the increase due to the vapour produced by the oil, was experienced; the volume being the same after one minute as it was after half an hour. The holder thus appeared to equalize the temperature with great rapidity. By means of this apparatus, the volume of vapour produced by the carburine could be easily and accurately determined; the greatest difference not exceeding 10 per cent., and the larger number of experiments agreeing within 5 per cent.

The volume of vapour from 1 gallon of carburine at 60° Fahr., 30 in. Bar., was found to be 30 feet, closely agreeing with the theoretical volume of hexane. In such an investigation as the one under consideration, the method of ascertaining the illuminating power is of great importance. It is much to be regretted, in this connection, that there is no recognized and rational system of valuing the lighting powers of different gases; it being considered quite sufficient in many cases to simply state the illuminating power, without either specifying the burner used or the rate of consumption when testing. In these experiments the "London" Argand was used, with a 6-inch chimney, the rate adjusted so as to give a flame on the point of smoking, and the illuminating power calculated to 5 feet per hour.

The additions of the carburine were usually made so that each was equivalent to 5 gallons per 10,000 feet of gas in the holder. Owing to the small increase in bulk due to the carburine, the effect was finally the same as adding 15 gallons in one operation; the amount actually added being at the rate of 15·2 gallons per 10,000 feet—a difference within the limits of other errors. As the enrichment of common gas is of most interest, a special ½-inch service

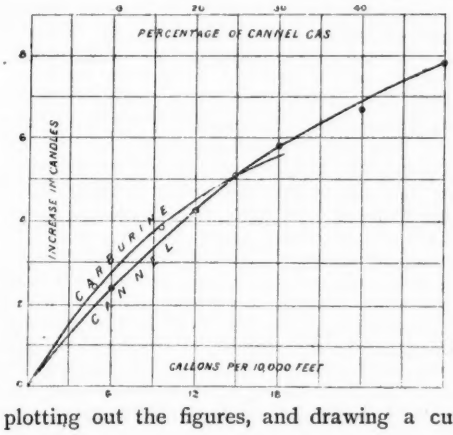
was laid on to the laboratory from a 1-inch service used occasionally on the works. For convenience, this service was taken along the walls of some buildings, and was exposed to a temperature frequently below freezing-point, which, added to the absorbent action of the boiled oil and red lead liberally used in the joints, had the effect of considerably reducing the illuminating power of the common gas. This was rather an advantage than otherwise, for the purpose for which the gas was required, as it increased the range for enrichment.

The difficulties attending the use of candles for such investigations were almost insuperable; but as they were the only instruments available at the time, there was no other course but to use them, or forego the experiments entirely. The same candles were used for each series of tests, and kept alight the whole time. The photometer was of the Evans type; the candles being moveable, and attached to a Keates's balance. The room and photometer were kept well ventilated; and the errors due to the nature of the apparatus as far as possible minimized.

The following two experiments are given as being considered the most trustworthy:—

TABLE D.—*Results of Experiments to Determine the Increase in Illuminating Power per Gallon of Carburine added.*

Illuminating Power of Original Gas.	Gallons of Carburine added per 10,000 Feet.	Illuminating Power. Candles.	Increase.	Gallons of Carburine added per 10,000 Feet.	Illuminating Power.	Increase.	Gallons of Carburine added per 10,000 Feet.	Illuminating Power.	Increase.	Total Gallons of Carburine added per 10,000 Feet.	Total Increase.
15·00	5	17·62	2·62	4·0	18·92	1·32	6·0	20·20	1·28	15	5·20
15·74	5	18·14	2·40	5·0	19·42	1·28	5·0	20·80	1·38	15	5·06
Average Result.											
15·37	5	17·88	2·51	4·5	19·17	1·29	5·5	20·50	1·33	15	5·13
General Result by Curve.											
15·37	5	17·80	2·43	5·0	19·40	1·60	5·0	20·50	1·10	15	5·13



By plotting out the figures, and drawing a curve to embrace them as nearly as possible, the figures are obtained in the table under the heading of "by curve." This will give the general result of the series.

If the quantity of vapour made by the carburine is ignored (and for this purpose it is sufficiently accurate to do so), it would be evident that each addition of 5 gallons per 10,000 feet should, by calculation, produce an equal addition to the candle power; and it was in order to decide this point that the experiments were made in this manner. The results, to the author's mind, point to a constant fall in the efficiency of the material. This action may, however, be common to other enrichers. An experiment was, therefore, made with mixtures of cannel and common gas; the mixtures being made so as to give 9 volumes of common to 1 volume of cannel, 8 to 2, and so on. The additions to the illuminating power in this case also would theoretically be equal. The results given in the following table show a similar fall, though not of such a marked character:—

TABLE E.—*Experiments with Mixtures of Common and Cannel Gases.*

Illuminating Power.		9 Common + 1 Cannel.		8 Common + 2 Cannel.		7 Common + 3 Cannel.		6 Common + 4 Cannel.		5 Common + 5 Cannel.	
Cannel.	Common.	Illuminating Power.	Increase.	Illuminating Power.	Increase.	Illuminating Power.	Increase.	Illuminating Power.	Increase.	Illuminating Power.	Increase.
30·6	16·38	18·82	2·44	20·66	1·84	22·20	1·54	23·00	0·80	24·20	1·20
General Result by Curve.											
30·6	16·38	18·80	2·42	20·65	1·85	22·10	1·45	23·20	1·10	24·20	1·00

Without attaching too great an importance to these figures, the author thinks they are of sufficient importance to warrant further investigation. Experiments are now being made by enriching cannel gas in the same way as the common. But although a fair agreement has been obtained for the three additions of 5 gallons per 10,000 feet of gas, there has been no apparent connection between the results obtained for each addition; the general effect being that the gas could be raised 4·6 candles, from 19-candle power, for the expenditure of the 15 gallons—a result about 7 per cent. lower than that obtained with common gas.

The author wishes it to be understood that the figures in these experiments are not taken as the precise value of the material as used on the large scale, but are given to show the probable tendency when varying the quantities used; the practical figures obtained with cannel, for instance, being somewhat better than those obtained experimentally with the common gas. From figures kindly supplied by Mr. Wright, of Bromley, it would appear that 8000 feet of 15½-candle gas can be raised to 16½ candles with 1 gallon of carburine; the gas being tested in each case with the "London" Argand at 5 feet per hour. This gives 1·25 gallons for each candle added to 10,000 feet of gas. If tested with the Argand, burning up to smoking-point in each case, the quantity required for 1 candle would probably be 1·50 gallons.

The effect of temperature in limiting the amount of vapour capable of remaining uncondensed in the gas, has an important bearing on this process. The investigations of Mr. George E. Davis, on the nature of the less volatile hydrocarbons in coal gas,* are of great value in considering this point. It may indeed be said that, without the assistance of his researches, it would be impossible to make anything but very vague guesses at the probable effects of temperature when using large quantities of the enricher. The boiling-points of the liquids found by Davis are given in Table F [next page].

The mixture of the vapour of a liquid of known tension at different temperatures with a permanent gas, offers no special difficulty to the determination of the point of saturation. A mixture of vapours, however, complicates the question. Without going into detail, the author believes he is correct in stating that, when two vapours are present in a gas, the liquids from which the vapours are found mixing freely, the tension is found to be not the sum, but a tension intermediate between that of each of the vapours taken singly. The addition, therefore, of other vapours to coal gas, now known to contain a large number, representing a considerable amount of liquids, requires some caution.

* See JOURNAL, Vol. XLIII., p. 143; and Vol. XLVII., p. 200.

TABLE F.

Gas distilled at high heats, illuminating power 17 candles, 4 gallons oils.
" " medium heats " " 19 " 3·2 " "

Illuminating Power after Extracting Oils, 8 Candles in both cases.

Boiling-Points of Hydrocarbons. Deg. C.	Medium Heats. Per Cent.	High Heats. Per Cent.
Below . . . 80 ..	2·0 ..	1·2
80—83 ..	53·0 ..	50·1
90—100 ..	3·6 ..	2·5
108—113 ..	21·0 ..	27·9
116—128 ..	3·2 ..	2·1
135—140 ..	8·1 ..	11·2
145—150 ..	2·0 ..	2·0
150—160 ..	3·3 ..	1·7
Above . . . 160 ..	3·8 ..	1·3
	100·0 ..	100·0

Cannel Oils.

Deg. C.	Per Cent.
Below . . . 23 ..	12·0
30—35 ..	1·5
35—73 ..	5·2
73—78 ..	11·2
80—83 ..	41·0
85—90 ..	5·0
90—100 ..	8·3
100—108 ..	4·0
108—113 ..	7·1
116—140 ..	2·4
140—160 ..	0·8
Above . . . 160 ..	1·5
	100·0

The author gives the vapour tensions of gasoline, carburine (for which a distillate, boiling at 150° to 161° Fahr., was taken—probably hexane), benzene, and a mixture of benzene and the carburine distillate. The tensions of gasoline are from figures by Davis; the others are mostly from experiments made by the author. The effect of benzene in lowering the pressure exerted by carburine is noticeable.

TABLE G.—*Vapour Tensions of Gasoline, Carburine (distilling at 150-161° Fahr.), Mixture of Benzene and Carburine Distillate, and Benzene.*

Temperature.	Tensions in Inches of Mercury.			
	Gasoline.	Carburine.	"Mixture."	Benzene.
Deg. F.				
32	3·2	2·5	2·0	1·1
40	4·0	3·0	2·5	1·5
50	5·2	3·9	3·2	2·0
60	6·7	4·9	4·1	2·7
70	8·3	6·1	5·1	3·5
80	..	7·5	6·1	4·7
90	..	9·3	7·1	5·7

Note.—The gasoline figures are taken from those published by Davis (See JOURNAL, Vol. XLVII., p. 200); the others are by the author. The limit of accuracy is 0·1 inch; the greatest error being probably 0·2 inch.

Taking the liquids from the vapours in the original gas as being equal to roughly 4 gallons per 10,000 feet, giving a volume of about 120 feet, and adding to this 6 gallons of carburine, volume 180 feet, and assuming the tension of this mixture equal to that of benzene, the gas would be saturated at 32° Fahr.

As the Clark-Maxim process is generally used to make up the deficiency in hydrocarbons in the cold weather, the illuminants whose places have to be supplied being probably those bodies of high boiling-point, there seems to be no reason why the gas, when moderately carburetted, should not be permanent. The results of the author's experience confirm this conclusion; none of the liquid having ever been found in the mains in his district.

The commercial aspect of the question is necessarily of greater importance than any theoretical speculations. But, unfortunately, money values are quite as open to errors as experimental data. The Engineers of The Gaslight and Coke Company take 50 gallons of carburine as being equal to 1 ton of Lesmahagow cannel. This value is adopted provisionally; but it is believed to be fairly accurate. For enriching cannel gas 2 candles, from about 20-candle power, the author takes 1·8 gallons per candle per 10,000 feet as the quantity required. At 9d. per gallon, allowing 1·5d. for the gas produced, 1 candle would cost 1·74d. per 1000 feet. The cost for enriching 16-candle gas (say) 2 candles, would probably not exceed 1·3d. per candle per 1000 feet. The author does not think it necessary to add another estimate of the cost of cannel to the conflicting values already published; but he believes the evidence in favour of carburine is sufficient to justify its use in the manner described.

THE COMPARATIVE VALUE OF VARIOUS OILS FOR ENRICHING COAL GAS.

By E. LLEWELLYN PRYCE, Birmingham.

The investigations detailed in the following paper were made under the direction of Mr. Charles Hunt, with the object of ascertaining the most suitable oil for use as an enriching material; and the writer ventures to think that, in view of the increasing importance of finding a substitute for cannel for enriching purposes, no apology is needed for bringing them under the notice of the members of this Institution.

The oils were gasified in a single cast-iron retort, about 6 inches internal diameter by 7 ft. 8 in. long; preference having been given to this form over that of the double or Pintsch retort, on account of the convenience of placing a number of them in a setting when any considerable quantity of oil gas is required. The oil was introduced at one end of the retort, by means of the usual funnel and syphon-pipe arrangement, and fell into a shallow pan, where it was vaporized. In passing through the heated retort, the vapours were converted into permanent gas, which made its way, by means of an ascension-pipe, to the hydraulic main, thence to a condenser and water scrubber (both of large area), and finally through a meter to a small gasholder. The hydraulic main, condenser, and scrubber were so arranged that the tar deposited in them could be collected for measurement. Considerable difficulty, however, was experienced in separating the water from it.

Although the tables giving the details of the experiments need little or no explanation, it is perhaps desirable to indicate how some of the results were arrived at. In the first place, the temperature of the retort was ascertained by means of a Siemens water pyrometer with iron cylinders—perhaps the most convenient of pyrometers, and one capable of giving fairly accurate results, as has been proved by comparing its indications with those of the Siemens electrical pyrometer, and also with those afforded by certain metallic salts, the fusing points of which have been ascertained by Carnelley.* The illuminating power of the oil gas was determined by consuming it from the largest of Bray's union-jet burners which could be employed without the flame smoking—the pressure being constant. As a standard of comparison, a Methven screen was used; its burner being supplied with carburetted coal gas.

It may not be uninteresting to quote some of the experiments which led to the adoption of this method of testing. A sample of oil gas gave the following results with different burners:—

Burner Employed.	Consumption in Cubic Feet per Hour.	Ill. Power for a Consumption of 5 Cub. Ft. per Hour.
Sugg's "London" Standard Argand No. 1	1·98 ..	29·9
	2·14 ..	32·1
	2·50 ..	31·2
" G Argand	2·30 ..	29·0
	2·68 ..	31·8
	3·04 ..	31·8
	3·33 ..	31·0
" K Argand	3·30 ..	30·5
	4·08 ..	31·5
	4·70 ..	29·8
" 70-candle Argand	5·57 ..	30·0
	5·62 ..	29·8
	6·33 ..	31·0
	7·08 ..	32·7
	8·22 ..	32·2
Bray's union-jet No. 0000	0·75 ..	30·6
	1·02 ..	31·9
	1·32 ..	32·8

No larger union-jet burners were tried with this sample of gas; but with another sample the following results were obtained:—

Sugg's K Argand	indicated	35·8 candles	for 5 c.ft. per hour.
" 70-candle Argand	"	40·7	" "
Bray's union-jet No. 0000	"	33·3	" "
" " " 00	"	44·2	" "
" " " 0	"	47·6	" "
" " " 1	"	49·6	" "
" " " 2	flame smoked.		

Although this method of testing rich gases apparently does not give their full value (see Table IV.), it is believed that comparable results may be thus obtained. The composition of the gas was ascertained by means of a modified Hempel's gas analysis apparatus; mercury being

* *Jour. Chem. Soc.*, 1876, p. 489.

TABLE I.—*Results of the Gasification of Oils at Various Temperatures. Rate: 1 Gallon per Hour.*

Name of Oil	RUSSIAN OILS.							SHALE OILS.			
	A.—"LUSTRE."				B.—"SOLAR DISTILLATE."			C.—AS SUPPLIED TO THE RAILWAY AND TRAMWAY COS.		D.—OBTAINED DIRECT.	
Number of Trial	I.	II.	III.	IV.§	I.	II.	III.	I.	II.	I.	II.
Temperatures.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
Temperature of retort at starting	1255	1385	1540	1616	1470	1400	1668	1473	1662	1425	1600
" " finish	1100	1435	1600	1569	1290	1490	1712	1570	1595	1470	1660
Mean temperature of retort	1177*	1410	1570	1592	1380	1445	1690	1521	1628	1447	1630
Temperature of scrubber	63	56	52	46	46	39	43	44	46	46	35
" " meter	62	58	56	54	53	48	48	50	50	48	44
Gas.											
Gas produced per gallon of oil (corrected to 60° F.) cubic feet	44·3	74·5	101·3	117·1	58·0	82·9	120·3	82·5	94·6	66·6	83·1
Illuminating power candles	30·8	49·6†	35·7	25·0	58·0	48·2	22·0	41·2	34·3	62·9	46·3
Multiple—Gas produced per gallon × illuminating power	1364	3695	3616	2927	3364	3996	2646	3399	3245	4189	3847
Specific gravity (air = 1)	..	0·667	(1) 0·5270 (2) 0·5240 mean 0·5255	0·442	0·909	(1) 0·7370 (2) 0·7320 mean 0·7345	(1) 0·446 (2) 0·448 mean 0·447	(1) 0·6630 (2) 0·6640 mean 0·6635	0·584	0·931	0·671
Composition of gas—	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Carbonic acid (CO_2)	0·2	0·6	0·5	1·7	0·5	0·2	0·2	0·6	0·0	0·2	0·5
Oxygen (O_2)	0·3	0·6	0·4	0·5	..	0·4	..	0·3	..	0·1	..
Unsaturated hydrocarbons ($C_n H_2$), &c.	11·4	28·3	17·3	11·6	42·3	28·4	8·3	26·9	19·4	45·6	27·5
Hydrogen (H_2)	57·3	22·6	..	37·7	..	20·7	..	16·8	..	8·5	..
Carbonic Oxide (CO)	2·7	1·0	2·4	0·7	..	3·5	..	0·8	..	2·1	..
Methane, &c. ($C_n H_2$), + 2	23·6	41·6	..	43·2	..	37·6	..	51·3	..	35·9	..
Nitrogen (N_2)	4·5	5·3	..	4·6	..	9·2	..	3·3	..	7·6	..
Sulphuretted hydrogen (SH_2)	none	..	trace‡	..	none	none	trace	none	trace‖	none	none
Total sulphur per 100 cubic feet of gas grains	3·0	..	10·4	..	..	8·9	..	2·0	3·1	3·7	1·8
Residuals.											
Residue left in retort per gallon of oil used oz.	15·0	15·0	26·5	36·0	2·5	7·75	44·0	1·0	0·75	6·0	6·0
Residue per cent.	11·3	11·3	20·0	27·2	1·8	5·6	31·8	0·7	0·6	4·4	4·4
Tar condensed in hydraulic condenser and scrubber per gallon of oil used fluid oz.	89·5	26·5	14·1	0·5	52·4	65·5	0·5	32·2	9·5	43·2	16·2
Specific gravity of tar (water = 1)	0·837	0·936	0·933	0·948	0·981	0·984	say 1·000	1·038	1·033	0·983	1·016
Tar per cent.	56·8	18·8	10·0	0·4	37·1	46·5	0·4	24·6	7·2	31·1	12·0
Percentage of Residuals	68·1	30·1	30·0	27·6	38·9	52·1	32·2	25·3	7·8	35·5	16·4

A.—"*Lustre*" *Oil.*

* The temperature of the retort was insufficient to gasify all the oil, a portion of which burned at mouthpiece when the lid was removed.

† Some of this gas was kept for three weeks in a small holder at a temperature of about 55° to 58° Fahr., and at the end of that period tested 49·2 candles.

‡ Not more than 0·6 grain per 100 cubic feet.

§ In this experiment the oil-retort was partly filled with incandescent coke, over which the oil gas was passed. It would be impossible to work this oil for many hours, on account of the retort becoming blocked with a deposit of carbon.

B.—"*Solar Distillate*" *Oil.*

This oil could not be worked for any length of time before the retort would require to be cleaned of the carbon deposited; and if the heat were allowed to reach 1700° Fahr., it would quickly be blocked.

C.—*Shale Oil.*

‖ Not 0·6 grain per 100 cubic feet.

This oil could be worked continuously for a considerable time, there being but a little deposit of pitch in the retort.

used as the confining liquid. Before determining the methane and hydrogen by explosion, the higher members of the paraffin series were absorbed by means of petroleum, as recommended by Professor Vivian B. Lewes.* Up to the present, only one sample of the tar has been examined; and this has been found to contain a hardly appreciable quantity of light nitrifiable hydrocarbons mixed with paraffin oils, the presence of which would render its being run into the coal-tar well inadmissible.

It will be observed from the tables that the Russian oils deposit a large amount of carbon in the retort. More especially is this the case with the "Lustre" oil. It would therefore be necessary, when working these oils, to stop occasionally for the purpose of removing this. With the shale oils, these stoppages would be much less frequent. It would appear from these experiments that at a particular temperature the oils give best results. At temperatures below this, the value of the gas falls off; and, notwithstanding the increased volume at higher temperatures, the value is also less. This result is contrary to that observed in the carbonization of coal, where with increased volume increased value ensues.*

In addition to the experiments which are tabulated, several have been made with oil from blast-furnace gases; but the results obtained are not promising. At low temperatures this oil affords but very little gas, and of no great illuminating power; while at higher temperatures stoppages are frequent, and the gas is of poor quality. The best result from this oil was but little more than one-half that obtained from shale oil.

In Table III. are given some results obtained on mixing "Lustre" oil with common coal previous to carbonization. There are, however, practical difficulties in the way of adopting this method on a working scale, one of which would be the objection to the introduction of undecomposed

* *Jour. Soc. Chem. Ind.*, 1891, p. 407; also JOURNAL, Vol. LVII., p. 692.

* Lewis T. Wright, *Jour. Soc. Chem. Ind.*, 1885, p. 656; also JOURNAL, Vol. XLVI., pp. 1007, 1059.

TABLE II.—*Description of the Oils, and their Comparative Cost for Enriching Coal Gas.*

Name of oil	A.—"Lustre."	B.—"Solar Distillate."	C.—Shale Oil.	D.—Shale Oil.
Price per gallon	3·2d.	3·5d. (price for 10-gallon drum.)	5·3d., *plus* carriage of empty barrels to Chester	3·3d., *plus* carriage from Scotland.
Specific gravity (water = 1)	0·826	0·8656	0·8495	0·854
Colour	Water white—bluish fluorescence	Reddish brown—green fluorescence.	Reddish brown—greenish fluorescence.	Reddish brown—green fluorescence.
Fractional distillation—(Thermometer in vapour)	First drop, at 115° C. 5 per cent. 140 ,, 10 ,, 146 ,, 15 ,, 152 ,, 20 ,, 172 ,, 25 ,, 176 ,, 30 ,, 190 ,, 40 ,, 205 ,, 45 ,, 212 ,, 50 ,, 217 ,, 55 ,, 224 ,, 60 ,, 230 ,, 65 ,, 234 ,, 70 ,, 243 ,, 75 ,, 255 ,, 80 ,, 262 ,, 85 ,, 270 ,,	First drop, at 110° C. 4 per cent. 170 ,, 10 ,, 238 ,, 15 ,, 246 ,, 20 ,, 252 ,, 25 ,, 255 ,, 30 ,, 267 ,, 35 ,, 271 ,, 40 ,, 276 ,, 50 ,, 285 ,, 55 ,, 291 ,, 60 ,, 320 ,, 65 ,, 345 ,, Thermometer rising rapidly	First drop, at 225° C. 5 per cent. 248 ,, 10 ,, 255 ,, 15 ,, 260 ,, 20 ,, 270 ,, 25 ,, 275 ,, 30 ,, 280 ,, 35 ,, 286 ,, 40 ,, 290 ,, 45 ,, 294 ,, 50 ,, 316 ,, 55 ,, 350 ,, Thermometer rising rapidly	First drop, at 250° C. 5 per cent. 275 ,, 10 ,, 285 ,, 15 ,, 288 ,, 20 ,, 295 ,, 25 ,, 300 ,, 30 ,, 320 ,, 35 ,, 335 ,, 40 ,, 350 ,,
Best results—				
Gas made per gallon	74·5 cubic feet	82·9 cubic feet	82·5 cubic feet	66·6 cubic feet
Illuminating power	49·6 candles	48·2 candles	41·2 candles	62·9 candles
Multiple	3695	3996	3399	4189
Cost (oil only) per candle per 1000 cubic feet—16-candle gas taken as a basis	0·86d.	0·88d.	1·56d.	0·78d.*

* Cost for carriage, about 25 per cent. extra.

TABLE III.—*Cost of Enriching Coal Gas calculated from increased Illuminating Power obtained on mixing "Lustre" Oil with Coal previous to Carbonization.*

Coal used.	Proportion of Oil used.	Multiple.	Increase in Multiple due to the Oil.	Approximate Cost (Oil only) per Candle per 1000 Cubic Feet for Enriching—16-candle Gas taken as a Basis.
	Per Cent.			
Harecastle nuts	..	171,991	..	..
,,	(1) 1·0	183,520	11,529*	..
,,	(2) 0·5	184,715	12,724	..
,,	(3) 0·5	180,760	8,769	..
	2·0	..	32,022	0·5d.
Holbrook coal	..	178,811	..	..
,,	(1) 0·5	189,497	10,686	..
,,	(2) 0·5	183,706	4,895†	..
	1·0	..	15,581	0·5d.

* A portion of the oil was not absorbed by the coal, and was left in the scoop.

† Heat of retort rather lower than usual.

TABLE IV.—*Relation between the Percentage of Hydrocarbon and the Illuminating Power of Oil Gas made at various Temperatures.*

Name of Oil.	Mean Temperature of Gasification.	Illuminating Power.	Percentage of Hydrocarbons.	Illuminating Power. Percentage of Hydrocarbons. 1 per Cent. of Hydrocarbons = Candles.†
	°F.	Candles.		
A.—"Lustre"	1177	30·8	11·4	2·70
	1410	49·6 / 60·6*	28·3	1·75 / 2·14
	1570	35·7	17·3	7·06
B.—"Solar Distillate"	1592	25·0	11·6	2·16
	1380	41·0	42·3	1·37
	1445	48·2	28·4	1·70
C.—Shale	1690	22·0	8·3	2·65
	1521	58·2	26·9	1·53
D.—Shale	1629	34·3	19·4	1·77
	1448	62·9	45·6	1·38
	1630	46·3	27·5	1·69

* Illuminating power (mean of seven experiments) found by mixing a small percentage of the oil gas with coal gas, and determining the increased illuminating power due to the admixture.

† 16-candle gas, as tested with the standard Argand, contains about 4 per cent. of hydrocarbons, 1 per cent. of which therefore equals 4 candles. Although the oil gas was tested with the burner which gave best results, 1 per cent. of hydrocarbon was only equal to about 1·8 candles. It would therefore appear that the oil gas was not burned to the best advantage, and that the hydrocarbons were not of equal value with those contained in the 16-candle gas.

paraffin oils into the coal tar. A few experiments were made in this way, using crude Russian petroleum (Novorossisk oil), but with negative results. It is believed that this heavy oil simply distilled over from the retort to the condenser for the most part unchanged.

THE TECHNOLOGY OF WATER GAS.

By ARTHUR MATTHEWS PADDON and THOMAS GOULDEN.

The theory of water-gas production is one of long standing—dating, indeed, as far back as 1780. From 1820 down to the present day, the principle and practice have been intermittently developed; but it is only within the last decade that anything approaching economical efficiency has been arrived at. Hitherto the operations of this industry, on an extensive and commercially successful scale, have been practically confined to the United States of America. There have been recently installations of different forms of water-gas apparatus erected in this country; but the question of their permanent establishment may be said to be still an open one.

It will perhaps be as well to enumerate here the reactions involved in the commercial production of water gas. This is brought about by the decomposition of steam in intimate contact with highly incandescent carbon—the latter generally in the form of coke or anthracite coal. The initial reaction is the disassociation of the steam into its component elements, oxygen and hydrogen. The hydrogen passes forward in a free state, while the oxygen combines with the carbon of the incandescent fuel to form carbonic acid; this, by prolonged contact therewith, being afterwards reduced to carbonic oxide. Water gas in theoretical perfection should therefore consist of equal volumes of hydrogen and carbonic oxide—

$$2\,H_2O\ (\text{steam}) + 2\,C = H_4 + 2\,CO.$$

A process as simple as the above presents few difficulties in practice. But as the chief, and indeed for many years the only field for water gas lay in its success as a rival or an auxiliary to coal gas for illuminating purposes, subsequent attempts at development were almost entirely in this direction; and the history of carburetted water gas may almost be said to include the advances made in the various methods of water-gas production pure and simple—the *sine quâ non* of carburetted water gas—and the highest attainable quality in water gas, having a similar standard of perfection.

Neither water gas nor its separate constituents have any illuminating power. The acquisition of this property depends, therefore, on some extraneous agent; and this process of enrichment has for some forty years past occupied the attention and energies of those concerned in the industry.

The whole of the apparatus for the production of carburetted water gas may be divided, for the purpose of consideration, into two distinct classes—viz., (1) Retort processes. (2) Generator processes. In the first of these the steam is decomposed by contact with carbon contained in a retort heated externally; thus securing in some degree

continuity of production. In these processes the admission of steam is generally utilized for the introduction of the oil used as a carburetting agent, and the decomposition of the former is accompanied by the gasification of the latter. The most important objections to this method are the imperfect reduction of the carbonic acid formed, and the unstable nature of the light-giving components. The high temperature of the fuel, requisite for the formation of the water gas, is also the frequent cause of decomposition of its illuminating constituents produced by the oil, resolving them into marsh gas and deposited carbon.

Among the many processes of this nature, perhaps the more characteristic are the following: (1) The Salisbury; (2) the Jerzmanowski; (3) the Tessié du Motay; (4) the Meeze; and (5) the Wilkinson.

Of these only the first can be called a true retort process, as in other plants of this description above enumerated, a generator of some form or other is used for the production of water gas; the retorts themselves being merely utilized for vaporizing the oil, and giving to the resultant gases a greater or less degree of permanency.

The "Jerzmanowski" apparatus (known also as the "Boot-leg" plant) possesses a novel feature in the insertion within the vertical and hindmost portion of the retort of a quantity of limestone ($Ca\ CO_3$); the gas being passed through this heated material in its progress to the hydraulic main. There is another "Jerzmanowski" process, in which the limestone is used in a secondary chamber, with a generator for the production of the water gas; its enrichment being subsequently effected by the "Tessié du Motay" process. Beyond its acting as a fixing agent in the same way as a heated fire-brick, it is difficult to ascribe any specific advantage to the use of the limestone.

The "Tessié du Motay" plant consists of a single generator, from which the blast gases generated in "blowing up" pass to waste through the stack-valve. The water gas, when made, is stored in a holder, and subsequently passed through a chamber charged with naphtha vaporized by steam. Having been thus carburetted, the gas is finally "fixed" in a bench of retorts specially set for that purpose.

The "Meeze" process is very similar. The water gas, generated in a pair of vessels alternately, is stored in a holder, from which a part of it passes through an ordinary gas-retort fitted with baffle-plates; oil being simultaneously injected. This is cracked up; and the carburetted gas, fixed in contact with the baffles, joins the balance of the water gas in the hydraulic main, and with it passes forward to the purifiers.

These processes are worthy of attention as exemplifying different methods of effecting results more economically attained by the generator or cupola processes. It will now be advisable to consider the latter, as the more important developments in carburetted water gas have been on these lines.

Of the many plants of this description, the following have been the most extensively adopted: (1) The Lowe; (2) the Grainger; (3) the Flannery; (4) the Van Steenburg; (5) the Loomis; and (6) the Springer.

With the exception of the Van Steenburg, these several forms of apparatus are all based upon a common principle of action—that of the "Lowe."

The distinctive and peculiar principle of the "Lowe" process consists in the utilization of the gases produced in the generator in "blowing up" the fuel for heating the carburetting and superheating chambers. This is accomplished by their subsequent combustion in these vessels, in direct contact with the checker-work which effects the vaporization of the oil and its conversion into permanent gas. Prior to the invention of this system, the generator blast products (producer gas) were wholly wasted; and either no provision was made for fixing the hydrocarbon vapours, or this was done in a fixing chamber, heated by an independent furnace.

In the Van Steenburg apparatus, although the sensible heat of the generator blast products is utilized to raise the temperature of a small superheating arrangement in the upper portion of the same vessel, no combustion of these gases is attempted; and the stability of the illuminants produced by the use of a crude oil, or an oil of high specific gravity in this apparatus, is somewhat doubtful, although by using light oils (such as naphtha, &c.), satisfactory results may doubtless be obtained.

In the "Lowe" form of apparatus, three shells are used for the production of the finished gas. These are respectively the generator, the carburetter, and the superheater—connected by cast-iron brick-lined sleeves. The generator is lined above the fire-bars with fire-blocks; and it contains the fuel bed. The coke-feeding branch is at the top; the blast inlet is immediately below the grates; steam being admitted by a series of distributing pipes at the same point. Four equidistant clinkering doors are provided just above the bars. The ash-pit is in the form of an inverted cone, tapering to a gas-tight door, through which the ashes from the fire fall for removal. The carburetter is lined in the same manner as the generator with 10-inch fire-clay blocks; and it is also filled entirely with a checker-work of fire-bricks laid in tiers. The admission of the air-blast for the combustion of the producer gases which heat this vessel takes place at the top. The superheater is precisely similar to the carburetter in the matter of lining and checker-work; but it is higher by about 8 feet. This additional height serves the double purpose of providing additional superheating surface where most required, and of inducing a brisk draught through the apparatus when the air-blast is closed and the generator doors open, thereby drawing the furnace gases away from the men working at the various openings.

The procedure of working may be briefly described as follows: A fuel bed of proper thickness being ignited in the generator, the blast is admitted. When the sensible heat of the producer gases in their passage through the carburetter has raised the top of the checker-work in that vessel to a dull red heat, air is admitted in sufficient quantity to cause, by the combustion of a portion of the producer gas, the raising of the brickwork to the desired degree of temperature. The balance of the producer gas passes over into the superheater, and is burnt there by the admission of a further supply of air effected at the bottom of that vessel; and, if necessary, to make combustion complete, some is also admitted half-way up. The burnt gases pass through a stack-valve on the top of the superheater into the atmosphere.

The appended analyses of the gases from the different vessels will show the relative combustion effected:—

	Producer Gas.		Stack-Valve Gas.
Carbonic acid	7·94	..	15·10
Oxygen	Nil	..	3·80
Carbonic oxide	23·21	..	0·10
Nitrogen	68·85	..	81·00
	100·00		100·00

It being necessary to raise the energy of the generator fuel to its maximum in a short time, more air is admitted than is required for the production of a perfect producer gas; and for the same reason a larger amount of gas is generated at times than can be conveniently consumed—the object in "blowing up" being to raise all three vessels to the desired temperature simultaneously, and in the shortest period of time possible. The fuel-bed, carburetter, and superheater being by a careful adjustment of the air supply brought to the proper temperatures, the blasts are shut off, beginning with the superheater; the stack-valve is closed; and steam is admitted under the generator bars. The process of simple water-gas production is thus brought into action. The following analyses have been made of samples taken from an 11-feet diameter generator:—

Analysis of Water Gas.

	From an American Plant.		From Beckton Plant.		
	Per Cent.		Per Cent.		Per Cent.
Carbonic acid	3·5	..	4·80	..	2·95
Carbonic oxide	43·4	..	45·68	..	46·06
Hydrogen	51·8	..	48·13	..	50·96
Nitrogen	1·3	..	1·39	..	0·03
	100·0	..	100·0	..	100·0

A very important property of this plant is the ease with which it may be brought into action in a short period of time. Starting cold, a plant of half a million per day capacity was raised to a working heat in 3½ hours.

In the manufacture of carburetted water gas, the oil is introduced into the carburetter by means of a small pump immediately after the evolution of water gas has commenced; and, being vaporized, it passes with the water gas through the superheater to the hydraulic seal, and thence to the scrubbers and condensers. The oil, prior to its admission to the carburetter, is superheated by the hot gas on its way to the seal. The oil is thus raised to a temperature approximating to vaporization-point before

reaching the checker-work in the carburetter, which effects its ultimate gasification.

Experience tends to show that the best results are obtained from an oil by gradual increments of temperature until the fixing of the hydrocarbons is completed. Thus the base of the superheater should be hotter than the carburetter; and again, the top of the superheater should be hotter than the bottom.

The precise duration of "runs" and "blows" can only be ascertained by actual experience of the particular oil and fuel used; but general practice points to the desirability of short runs and blows. The "run" (period of gas making) must of necessity terminate when the energy of the fuel-bed begins to decrease to any great extent. The quantity of steam admitted must be most carefully adjusted. An insufficiency limits the volume of gas made; an excess causes the production of a large percentage of carbonic acid.

Water Gas in Consecutive Minutes of Run.

	1.	2.	3.	4.	5.	Average.
(1) CO_2	0·6	2·4	5·0	6·6	7·6	= 4·4 per cent.
(2) CO_2	0·4	1·0	3·2	5·8	8·2	= 3·7 ,,

It may be here stated that, when carburetted to 26-candle power, 60 per cent. by volume of the mixture consists of pure water gas.

The criterions of relative efficiency in the working of a carburetted water-gas plant are the following:—

1. The fuel required per 1000 feet of gas made.
2. The oil required per 1000 feet of gas made.
3. The candle power per gallon of oil developed.
4. The character and grade of oil most economically worked in the apparatus.
5. The percentage volume of carbonic acid in the crude gas.
6. The capital expenditure on the erection of plant.

With reference to the first of these standards, it may be assumed that in general practice, from 40 to 50 lbs. of gas coke will be consumed per 1000 cubic feet of gas made. This figure has been arrived at as the result of both American and English experience. It covers the fuel used in the generator, and under the boiler supplying the steam necessary for the run, and for driving blowing engines, exhausters, and pumps. In American practice, according to Mr. Alexander C. Humphreys, in his treatise on water-gas plant, in the United States, some 5 gallons of Lima crude oil per 1000 feet are used to carburet water gas to 26-candle power. The different nature of the oil hitherto used in England, however, makes this valueless as a comparative standard.

With regard to the class of oil amenable to successful treatment, so far as experience has gone, it would appear that the leading drawback to the use of crude oil is the presence of free carbon or pitch in excessive quantities. Provided that the solid residue from an oil in ordinary distillation does not exceed 2 per cent. by weight, it would be fairly safe to assume the oil to be of a workable character. Specific gravity alone offers no criterion of the efficiency of an oil for the purpose; very satisfactory results having been obtained from oils of a higher specific gravity, and very disappointing ones from some possessing a low gravity, having due regard to the higher price of the latter quality. The use of an oil with a high percentage of pitch is attended with the eventual blocking of the carburetter and superheater with deposited carbon, necessitating the suspension of gas manufacture for some hours, until it can be burnt out. With a clear oil, the only appreciable deposit would be a very fine ash on the checker-work of the vessels, which would require renewing about every six months. The degree of heat for the fixing and superheating of the gases, demands careful attention; the vapours from some oils requiring a very high temperature to render them thoroughly permanent, while others, under the same conditions, deposit lamp-black freely.

The presence of carbonic acid in the crude gas is a most serious matter; 1 volume per 100 reducing the illuminating value by 4 or 5 per cent. Not only this, it represents a percentage of impurity, calling for removal, which should have been reduced to a valuable and active constituent—viz., carbonic oxide. Although carbonic acid, theoretically, has no place in water gas, yet in the economical production of the latter it will always be present. It is found in practice that it can be kept (using gas coke in the generator) at about 4 per cent. of the volume of the crude gas produced. Neglect, however, to preserve the energy of the fuel-bed, or to properly regulate the "runs" and "blows," is likely to raise the carbonic acid to about 9 or 10 per cent. Its production practically varies inversely with the energy of the fuel.

The other impurities in the gas are inconsiderable. There are traces of sulphuretted hydrogen and ammonia, neither of which needs special means for its extraction. The percentage of "carbon bisulphide" impurities also is low enough to obviate the necessity for their removal, even from the gas supplied to the Metropolis. As a matter of fact, it is about 4 grains.

The tar produced is of a light spirituous nature, unfortunately associated with some 70 per cent. of water, remaining after the bulk thereof has settled out by gravitation. This is owing to the high temperature of the gases passing through the hydraulic seal, which is continuously and copiously supplied with water, in order to cool it down between the runs. This supply, and the sprays in the scrubber, account for the large amount used—viz., 60 to 80 gallons per 1000 feet of gas made. The tar deposited in the condensers is freer from water—only containing an amount which is vaporized by the heated gases passing the seal and scrubbers, and in which it is condensed.

In disposing of the tar, it will be found convenient to store that from the condenser separately, and to circulate the watery portions from the hydraulic seal and scrubber continuously, relying upon an auxiliary supply to maintain the volume reduced by vaporization, and occasionally withdrawing the very light tar from the surface of the circulating tank, and any heavy tar which may have settled out at the bottom.

The distillation of the tar is, for the reason above mentioned, associated with much difficulty, since it is mostly in the form of an emulsion, which causes foaming in the stills, and frequently necessitates redistillation of the distillates. Appended is an analysis of the tar after the water has been as far as possible separated by gravitation:—

Approximate Analysis of Oil Gas Tar taken from Condenser Seals, from the 1st to the 6th of January, 1892.

[Specific gravity of tar = ·996.]

	Per Cent. by Volume.		Per Cent. by Volume. Calculated without water
Water	76·50	..	
Benzene	0·28	..	1·19
Toluol	0·90	..	3·83
Light paraffins, &c.	2·00	..	8·51
Solvent naphtha (zylolete)	4·15	..	17·96
Phenol	only a trace	..	only a trace.
Middle oils (naphtha, &c.)	6·92	..	29·44
Creosote oil and green oil.	5·70	..	24·26
			Per Cent. by Weight.
Naphthalene	0·30	..	1·28
Anthracene cake	0·22 (Contains 8·33 per cent. anthracene.)		0·93
Coke.	2·30	..	9·80
	99·27	..	97·20
Loss	0·73	..	2·80
	100·00	..	100·00

The shells of the different vessels used in the "Lowe" process are of boiler-plate, and should be gas-tight under a pressure of 3 lbs. on the square inch. The maximum pressure to be anticipated in ordinary work may be taken at 40 inches of water; and the average pressure in the generator, at 30 inches during gas making. Ordinary Stourbridge fire-brick furnishes a suitable material for the lining, between which and the shells is an annular space of 2 inches, tightly packed with some non-conducting agent, such as slag, wool, asbestos, or wood-ashes.

The superficial area of the checker-work for fixing the gases is about 16 square feet per 1000 cubic feet made per diem, irrespective of linings and flat arches. These latter occur where the blast is admitted; and a space, some 2 feet in depth, is left devoid of checker-work below the soffit of the arch, forming a chamber for the combustion of the gases.

The apparatus is manipulated from a raised stage of wrought-iron framework, with cast-iron plates, level with the top of the generator; and an elevator is required for raising the coke used in feeding the generator to this level.

The blast-valves must be the best of their kind. It is necessary that they should open and close easily, at the same time being perfectly gas-tight. A 1¼-inch service is fitted to the blast side of all these valves, communicating with a common outlet on the working floor. During the "runs," the mouth of this is automatically opened; and

any back leakage of gas is at once indicated to the workmen manipulating the plant.

The blast-mains, from 16 to 20 inches in diameter, are of galvanized iron, No. 18 B.W.G., and are provided with relief valves for excessive pressures; the average blast being equal to 14 inches head of water. The blowers supplying the blast work at 2000 revolutions per minute.

The oil for carburetting is raised by a pump on the ground level to a measuring tank upon the upper floor, fitted with a gauge-glass and graduated scale; and the oil is drawn therefrom by a small pump, by which it is forced through the oil heater, into a spray in the carburetter, at a pressure of about 25 to 30 lbs. per square inch.

A relief holder is an indispensable adjunct for the convenient and safe working of water-gas plant. It has a common inlet and outlet, and works as a differential governor, taking the excess gas that the exhauster fails to pass, or supplying gas to the exhauster when the production is diminished below its capacity.

A few figures are given below as to the capital involved in the erection of a "Lowe" carburetted water-gas plant, for the production of a million feet per diem of twenty-four hours. The cost for such a plant may be taken at about £8000 to £9000.

Building	£2000
Plant	1700
Boilers, &c.	750
Engines, blowers, &c.	500
Coke elevator	210
Exhauster and engine mains	950
Relief gasholder	2000
Oil-storeage tank	700
	£8810

The above would be the cost of a plant for the enrichment of ordinary coal gas. Meter and purifiers therefore are not estimated for; it being assumed that the existing apparatus would be used. These, if capitalized, might be estimated at from £3500 to £4000.

[Appendix.]

Analysis of Crude Carburetted Water Gas.

Gallons of oil used per 1000 cubic feet	5·46
Illuminating power of gas (candles)	24·68
Candles per gallon	9·03
Class of oil used, a rough distillate from Russian crude.	
H	21·8
CH_4	30·7
CnH_3N	12·9
CO	28·1
$H_2S + CO_2$	3.8
O	0·5
N	2·2
	100·0

Experimental Tests of Oil.

[Quantity used: 1 gallon.]

Class of Oil.	Gas Made in Cubic Feet.	Illuminating Power.	Illuminating Power per Gallon in Candles.	Specific Gravity of Oil.	Flashing Point of Oil.
		Candles.			Deg. F.
(*a*) Crude petroleum	95	47	893	0·864	54
(*b*) Crude Russian oil (Noverissisk)	91	57	1037	0·950	186
(*c*) Portesham shale oil	76	55	836	1·0023	142
(*d*) Distillate from Russian crude oil	89	55	979	0·910	125
(*e*) Peruvian crude oil	90	66	1188	0·856	65
(*f*) Refined oil	90	61	1098	0·824	86
(*g*) Solar oil	90	55	990	0·884	265
(*h*) Solar distillate	91	53	964	0·861	125

Remarks.—(*a*) Flashes at normal temperature. (*b*) Thick, dark oil. (*c*) Dark, pungent oil. (*d*) Opaque in colour. (*e*) Flashes at normal temperature. (*f*) White oil. (*g*) Yellow oil. (*h*) Pale yellow oil.

A DESCRIPTION OF A SIX-LIFT GASHOLDER AND TANK NOW BEING CONSTRUCTED AT EAST GREENWICH.

By Frank Livesey.

It is not generally customary to write papers on works in progress; the wiser plan being to wait for the completion of the undertaking. As, however, it is the intention of this Institution to visit the works where this holder is being erected, there is a good reason for departing from the usual custom.

The tendency lately has been to increase the size of gasholders quite out of proportion to the natural increase in consumption of gas—brought about, probably, by several and obvious reasons; one being that gas can be stored more cheaply in large holders, and another by the great variations in consumption that now take place. The use of gas for domestic heating is usually greatest at the time when it is most required for lighting—that is, in the depth of winter. It is not, therefore, unusual in large towns to have a triple combination of intense cold, short daylight, and what there is of it obscured by fog, giving rise to an increase in consumption of 16 to 18 per cent., and that too, probably, when every retort is at work. To meet such demands, the most economical plan is to have ample storeage, not necessarily in large holders, though if economy in construction is considered, it is best obtained in that way.

For the easy and safe guiding of a gasholder, the depth of the lift is usually made about a quarter to one-fifth of the diameter, though there are cases where a depth of one-eighth has been used. A deep holder requires a deep tank, which, in most cases, means an expensive one, especially if in a water-bearing soil. If, therefore, the difficulties of guiding a shallow holder can be overcome, it is an advantage to have a shallow tank.

The gasholder which it is the object of this paper to describe, is now being erected at East Greenwich, on ground having the River Thames on three sides. The upper soil is a thin layer of clay, with 6 or 8 feet of peat underlying, beneath which is a deep layer of loose gravel cropping out in the channel cut by the river, and so providing a copious supply of water in any excavation which enters it. The water, in fact, rises and falls with the tide.

In designing the tank, the first object was to avoid the heavy cost of pumping; and it was accordingly determined to carry the tank-wall just into the gravel—deep enough, in fact, to obtain a good foundation. The depth of the tank in the ground having been settled at 13 feet, the next point to be determined was the height above ground. This was settled at 21 feet. It is usual when building a gasholder much above ground, to make the tank an annular one of cast or wrought iron; but as hard core and ballast are cheaply obtained, it was decided to build the tank of concrete with an earthwork backing.

In a concrete tank depending upon the rendering for its tightness, the entire strain due to the internal pressure of the water comes on the concrete, the slightest crack in which will cause the tank to leak. The circumstances are quite different in a tank with a puddle lining outside, and when the water can permeate through the brickwork or concrete. The puddle there forms the tank, yielding to any slight inequalities of pressure without cracking. To make a concrete wall strong enough to resist cracking, standing 21 feet above ground level, even though well backed up with earthwork, would require a very thick wall, if dependent on the concrete only; and for this reason iron bands 5 inches by $\frac{5}{8}$ inch have been inserted about 2 feet apart vertically, riveted to form a complete ring and strutted outwards, while filling concrete around them.

The concrete was composed of Thames ballast, clinkers, broken retorts, and fire-bricks—eight parts to one of cement. This mixture forms a tougher wall, in the author's opinion, than one made of all Thames ballast. The clinkers, having a very rough and irregular surface, hold the mass together better than the rounded pebbles generally found in ballast, though, probably, ballast concrete may be stronger to resist crushing.

Little or no earth has been left in the centre of the tank; for the reason that the greater portion consisted of peat. It would be of little use covering such material with concrete and cement-rendering, and then subjecting it to the pressure of 28 feet head of water, as the peat would be compressed and the rendering crack.

The wall of the tank is 3 ft. 6 in. thick at the top, increasing to 4 ft. 6 in. a little below the ground line. It then becomes a 5-ft. parallel wall to the bottom, no filling—which is seldom as solid as the unmoved soil—being required at the back of the wall. This is stronger and more economical than making a regular slope to the back of the wall, which would require timber-framing for its whole length, both above and below ground.

The inner circle of the concrete wall was set out with a trammel of the simplest and most inexpensive description; being merely a few boards bolted together, with a piece of flat iron screwed to it. That the tank did not vary 2 inches in diameter, proves that the instrument was sufficient for its purpose. But such accuracy in concrete is not obtained without great attention and supervision; for which credit must be given to Mr. Tysoe, the Engineer-in-Charge, and

to Mr. Stradling, the foreman of works—the Company being their own contractors for the tank.

It is not proposed to go minutely into the details of construction of the holder, but rather to describe what may seem novel or interesting—such as, for instance, the system of carriages and rollers, and the difficulties of guiding so shallow a holder.

There are six lifts. The inner one is 287 ft. 6 in. by 31 ft. deep; the second, 290 ft. by 32 ft.; the third, 292 ft. 6 in. by 32 ft.; the fourth, 295 ft. by 31 ft. 6 in.; the fifth, 297 ft. 6 in. by 31 ft. 3 in.; the sixth, 300 ft. by 31 ft. The proportion of diameter to depth of side is a little over nine to one—about the proportion given by the diameter of a penny to twice its thickness. The working capacity of the holder will be 12,200,000 cubic feet. The system of radial and tangential rollers, introduced by Mr. George Livesey, has hitherto worked very satisfactorily; but in a holder of six lifts, it is a difficult matter to pack a nest of six radial and tangential rollers and carriages, one above another, in a reasonable space. The plan has, therefore, been introduced, by the same gentleman, of placing the rollers at an angle—that is to say, neither radial nor tangential, but midway between the two, so combining somewhat the advantages of both.

In this case they are alternately radial and angular; beginning with angular ones on the top curb, and ending with the fifth and sixth angular. Of these upper ones there are 32. At the bottom of the inner lift, there is a wrought-iron carriage holding tangential and radial rollers; at the bottom of all other lifts, a radial roller only. In all these latter cases, there are 64, or double the number of standards; so that the inner lift, which is the difficult one to guide till cupped, has angular rollers at the top, and radial and tangential rollers at the bottom.

The experience gained by the working of three holders on the angular system, shows that they are as steady as when the combined radials and tangentials are introduced; and they have this convenience, that they require shorter legs to attach them to the holder, and are more easily fixed. Should it, however, be necessary to gear the inner and second lifts together, arrangements have been made so that it can be easily done.

Under ordinary circumstances, the vertical stays of a holder 31 feet deep are not required of very great stiffness; but in the present case, where two lifts rise beyond the framing, the inner and second lifts are subjected to severe strains during strong winds when the holder is full. To resist such strains, the inner lift has 64 vertical stays—32 opposite the standards, and 32 placed midway between. They are composed of semicircular plates, 12 inches by 12 inches, No. 10 B. W. G.; those opposite the standards being inclined out at the top, so as to reach the inner curb angle steel.

The second lift has 128 stays—64 inside, of channel iron, forming the roller-path of the radial and tangential rollers, and 64 half-round sheet-iron ones outside at intermediate positions. The vertical stays on the other lifts are 64 channel irons, 7 inches by 3 inches by $\frac{1}{2}$ inch, forming the roller-paths.

The crown is a segment of a sphere rising 25 feet in the centre; all the sheets being steel, weighing 5·7 lbs. to the square foot. With holders of 250 feet diameter and upwards, there is a difficulty in obtaining sufficient pressure before cupping for the purposes of distribution. To maintain a pressure of 15-10ths throughout the district, something over 3 inches of pressure is required, unless the mains are of unusual size. As the inner lift of this holder will not give this pressure, the difficulty will be overcome by pumping the gas into heavier holders at the Old Kent Road. Weight is not wanted when the holder is full. There is then too great a pressure; so that a permanent dead weight is out of the question. There are also many difficulties in arranging to increase the pressure by weighting with water—which is one way out of the difficulty—as the water could run in by gravitation to a circular chamber round the curb, constructed possibly with partitions in it, and run out again when not wanted. If this water ballast, however, could not be placed in the chambers evenly and simultaneously all round the circle, it must not, of course, be used at all, as it is only wanted when the inner holder is uncupped and in its most unstable position.

The curb of the inner holder is built up of 3 ft. 6 in. by 1 in. steel plate on crown, followed by a 24 in. by $\frac{1}{2}$ in. iron, and a 24 in. by $\frac{1}{2}$ in. also iron, a 12 in. by 1 in. steel, and a 12 in. by $\frac{1}{2}$ in. iron, with a 6 in. by 6 in. by 1 in. angle steel at the curb, and a 6 in. by 4 in. by 1 in. on the first ring plate. This is equal in section to 75 square inches in steel and 24 inches in iron; but as the iron plates are lap-jointed, only 12 inches is taken.

	Tons.
75 inches by 7½ tons on the square inch, as a safe compressive strain, steel = ...	562
12 inches by 4 tons on the square inch, as a safe compressive strain, iron = ...	48
	610

Giving 610 tons as the total safe resistance to compression of this section of curb; whereas, according to Mr. Cripps's formula, the actual strain on the curb equals 600 tons.

The usual plan of inserting foundation bolts to hold the standards has been departed from in this case; as it was thought that a better hold could be obtained on the concrete, and that it would be a cheaper and a more ready plan to insert three flat-iron bars in the concrete, in a raking position, turned up in the form of a hook at the lower end, and at the upper end standing above the concrete about 18 inches or 2 feet, in such a position as to be easily riveted to the standards.

The standards are 32 in number, H-shaped in section, 2 ft. 6 in. deep at the base, tapering to 1 ft. 10½ in. at the top, 125 ft. 10 in. high; thus allowing two of the lifts to rise beyond the framing. They have no horizontal attachment except at the top, where there is a strong girder 2 feet deep with a 22-inch top flange, forming a pathway round the top, securely attached to the standards, and connected together by a 12-inch gusset plate with angle-iron underneath, running round the back of the standard, and thus forming a continuous pathway at that point, and giving rigidity to the weak joints in the 32-sided figure which the framing forms.

As there are no horizontal members to form struts, with the exception of the top girder, the diagonals are made T-shape in section, formed of two flat bars connected with an angle-iron 12 inches by $\frac{5}{8}$ inch and 12 inches by $\frac{1}{2}$ inch at bottom, with intermediate sizes terminating with 8 inches by $\frac{5}{8}$ inch and 10 inches by $\frac{1}{2}$ inch at the top. They thus answer the purpose both of ties and struts; for there is little doubt they play this double part according to the direction of the wind.

The flat bars combined with a horizontal strut, formerly used, do their work satisfactorily; but they are somewhat difficult to adjust when fixing. The same object is gained with one-third less members in the structure, saving a considerable amount of time in erection.

Undoubtedly an important object in designing this gasholder has been to obtain cheap and safe storeage; and if a comparison may be made with the cost of existing gasholders erected for the South Metropolitan Company, success may certainly be claimed. The oldest gasholder now possessed by the Company, containing 166,000 cubic feet, cost at the rate of £24 5s. 3d. per 1000 cubic feet; the first gasholder constructed with wrought-iron standards and flat-bar diagonals, holding 5,500,000 cubic feet, cost £47,000, or at the rate of £8 10s. 3d. per 1000 cubic feet; while the present one will cost about £61,000, being £5 per 1000 cubic feet, or £8000 less than the first one erected at East Greenwich, and containing 4,000,000 feet more gas.

Messrs. Clayton, Son, and Co., Limited, are the contractors for the gasholder. They have engaged to complete the work by the 1st of October of the present year; and they are sanguine that they will succeed in their endeavour.

Death of Lord Bramwell.—The death of Lord Bramwell at his country residence, Holmwood, Edenbridge, last Tuesday, at the advanced age of 84, has removed one whose name will be remembered by many of our readers in connection with the work of the Liberty and Property Defence League. His Lordship took considerable interest in economic science; and only four years ago presided over the Section devoted to this subject at the meeting of the British Association. An appreciative writer in *The Times* (to which paper Lord Bramwell frequently contributed over the signature "B") says his Lordship had an utter disbelief in the benefit of State interference; *laisser aller, laisser faire*, was in his view the highest wisdom." Yet he was not so insensible to the evils and misery existing under the present constitution of society as was apt to be supposed. "Every good man has been at some time of his life a Socialist," he often said; never failing, however, to add, "and, if wise, very soon ceased to be one."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 927.)

THE "Great Revival," so long looked for and so ardently desired, appears to be coming at last. Forced on by the large and increasing superabundance of money, purchases of investment stocks are gradually bringing about a general resumption of business, extending to the less favoured and more speculative issues—the supply of the first class not being unlimited. Prices thus have gone up gaily during the week; though a little checked towards the end, when the temptation to snap up a realizable profit became too great to withstand. As for the Money Market, it is, if possible, easier than ever; and the minimum rate looks as if it were going to last a long time. The Gas Market has been pretty active, and prices on the whole were well on the rise. The feature of the week was the recovery in Gaslight "A." Opening at 207, the best price in the week before, it speedily began to move; and, once started, it went along like a ball rolling, and finished with business done at 216¼. A pleasant sight for those who sold at 202 a fortnight ago! A fair amount of business was done in the debenture and preference stocks; but not more than was to be expected in view of the great demand for superior investment stocks. Some of the debentures consequently rose slightly in value. South Metropolitan were steadily done at very level figures; and the quotations for "B" and the debentures advanced. Commercial old was put down 1; but little business was done in it. The Suburban and Provincial Companies were very quiet—hardly a deal being done in them; and the only change was a rise of ½ in Bromley new. Continentals were firm, but did not attract much notice. Movements in the rest have been variable. Among the South Americans, Buenos Ayres rose ½; but San Paulo receded to a similar extent. Bahia fell 2; the outcome of their negotiations with the local authorities not being looked forward to very hopefully. Metropolitan of Melbourne rose 1. Business in Water was moderate. The upward movement, however, still continues; and East London, Kent, and West Middlesex are all higher. A comparison of present quotations with those of six weeks ago is interesting and instructive.

The daily operations were: Business was moderate on Monday, mostly in Metropolitan and Suburban undertakings. Gaslight "A" rose 1; and Bromley new, ½. But Commercial old fell 1. Kent Water was opened out to 250-260. There was rather more activity on Tuesday. Gaslight "A" moved up 2 more. Melbourne debentures rose 1; but Chicago second mortgage bonds fell 2½. Wednesday's transactions were largely in Gaslight "A," which advanced 1; and the debenture issues also rose as noted in the list. All interest on Thursday was still centred in Gaslight "A," which made a further advance of 2½. Kent Water rose 5. On Friday, business was rather quieter; but stocks moved up freely. Gaslight "A" and South Metropolitan "B" rose 1 each; ditto, debenture, 1½; Buenos Ayres, ½; and Chicago second mortgage bonds recovered their 2½ fall. Bahia, however, fell 2. West Middlesex rose 3; and East London, 2. Saturday was quiet as usual; but Gaslight "A" got up 1 more. West Middlesex Water lost half its rise of the previous day.

ELECTRIC LIGHTING MEMORANDA.

The Meeting of the Shareholders of the Metropolitan Electric Supply Company.—The Incandescent Electric Lighting of the Chicago Exhibition.—The Board of Trade Unit under a New Name.—The Fruitless Electrical Exhibition.

THE Metropolitan Electric Supply Company have held their general meeting, under the presidency of Sir John Pender; and the proceedings were of the quietest description. The assembled proprietors accepted the statement of accounts which we criticized last week; only one shareholder venturing to express his belief that the dividend to be paid had not been earned. This, the Chairman remarked, is a "matter of opinion;" but a Board are practically omnipotent in these respects, and when Directors recommend a dividend—however small in amount—it is very rarely declined. Yet the circumstances of this particular concern are such as might reasonably inspire dissatisfaction, if not distrust, in the mind of any shareholder. All the capital has been spent, and the capital account is still open; and, in addition, the Board declare their intention of issuing £100,000 worth of 5 per cent. debentures at par. No wonder they strained a point to enable themselves to recommend a dividend, which was indispensable for "sugaring" the debenture "pill." The Chairman comforted his auditory by reminding them that there is another electric lighting concern, under different management, in very much worse plight than the Metropolitan; and he asserted that the applications for light received at this Company's offices during the past three weeks were "the largest number ever obtained in the same time." It is a most convenient thing that these phenomenal increases of the business of electric lighting companies so commonly accrue in the interval between the making up of the yearly or half-yearly accounts and the holding of the meeting! We notice, however, that Sir John Pender has given a sort of engagement that, when the extensions already in hand have been completed, the Board will wait and see how matters go before launching out again. He recognizes, of course, that electric lighting companies cannot work upon suspense accounts for ever, and that sooner or later the revenue account must express the true state of the business. And this period cannot be far off in the case of the majority of the London Companies.

Some peculiar statements have been made, and have been commented upon in these columns, with regard to the arc lighting proposals for the Chicago Exhibition. It has since transpired that there has been quite as much "unpleasantness" about the incandescent lighting as was caused by the cupidity of the arc lamp contractors. When the tenders for the incandescent lighting were opened, the Edison Company were found to demand $18·50 for every lamp for the period of the Exhibition; which for the estimated requirement of 93,044 lamps would have amounted to a total lighting bill of $1,721,314—or, in British currency, the modest charge of about £345,000. This was too much, even for the Exhibition managers; and they accordingly rejected the tender. Thereupon the usual negotiations ensued; and, as a result, the Edison Company cut down their price to $5·95 per lamp, which was accepted. Thus the Exhibition managers have saved the difference between $1,721,314 and $553,409, or the by no means despicable sum of £233,600, out of a demand for £345,000. This is bargaining, with a vengeance. The American electrical press naturally thinks that this is a bit of news which is "calculated to give a bad impression"—but of whom there seems to be some doubt. Plain people might imagine off-hand that the discredit rests with the Edison Company; but this is not how the matter looks to the electrical scribes, who put it all down to "the lack of knowledge as to the costs of electric light and power which is so sadly displayed by the Management of the World's Fair." At any rate, the Exhibition authorities appear to have a shrewd idea of how much electric light ought to be had for a dollar; and they seem to know tolerably well how to deal with their contractors.

It has been announced that by the complaisance of the Board of Trade, and with the acquiescence of Lord Kelvin, the Board of Trade unit of electricity is henceforward to be called a "kelvin," after his scientific lordship. With regard to this suggestion, the scientific press is unable to offer any consensus of opinion. It seems to be thought that, if the convenient B.T.U. needs a name, the accommodation may as well be provided by calling it after the noble lord who has been the first to illustrate the universality of the British peerage, and the adaptability of our peculiar "hereditary chamber" to modern conditions. But why must the Board of Trade unit be called after anybody? Surely the phase as it stands is as explicit as the older term "thousand cubic feet" used in the commercial measurement of gas? When anybody mentions a Board of Trade unit, or even speaks of the "unit" without reference to its creator, there is no difficulty in following his meaning; but to call the thing a "kelvin" opens up a train of connected thought which is irritating and tiresome. But this sort of thing is an inevitable nuisance. The botanists began it, and all the scientific tribes have followed suit, until we see men's names given with small discrimination to diseases, lakes, mountains, plants, parasites, and, lastly, to a determinate quantitative manifestation of something which is called electricity. We do not like it. There is in reality no more justification for calling a Board of Trade electrical unit a kelvin than there would be for calling a "screw" of tobacco a "Raleigh," or "four of Scotch" a "Burns."

There is a fashion in scientific experiments as in other things. Since Mr. Tesla drew the attention of the "Upper Ten" of science to the phenomena of high voltage currents of rapid alternation, there has been quite a rush of imitators in the same class of performances. Messrs. Siemens first did this sort of thing at the Crystal Palace; and they were quickly followed by the agents of the Thomson-Houston system in England, and, lastly, by Mr. Swinburne. Meanwhile the general public has begun to remark that, while these displays are very pretty examples of electrical fireworks, they are scarcely "business." And so it is unquestionably true that the approaching termination of the Crystal Palace Exhibition without seriously advancing either the science or the practice of electric lighting is being felt in ever-widening circles as a reproach to all concerned, which it will take more than the success of the show as a mere advertisement of a few trading firms to remove.

"GAS AND GAS-WORKS."

THE expected new edition of the well-known "Hughes on Gas-Works," by W. Richards, which was a once well-known volume of Weale's series of technical handbooks, has appeared.* The preceding (seventh) edition has been out of print for some time, during which some notable advances have been made in the technology of gas manufacture. Among these, the veteran

* "Gas-Works: Their Construction and Arrangement, and the Manufacture and Distribution of Coal Gas." Originally written by Samuel Hughes; re-written and much enlarged by William Richards. Eighth edition. Revised, with Notices of Recent Improvements." London: Crosby Lockwood and Son; 1892.

Editor enumerates the improvements in the construction of gas-holders, the general application of machine stoking, the automatic preparation of sulphate of ammonia, Claus's sulphur-recovery process, and "the purification of gas by air or oxygen gas." Mr. Richards's language is rather comprehensive than exact; for coal gas is not, strictly speaking, purified by either air or oxygen. The foundation of this book was laid by the late Mr. Hughes; and its character has not been materially altered by Mr. Richards. It was never a work of brilliant genius; and a student who confined his technical reading to it would miss a good deal he ought to learn, while running some risk of absorbing some "very old and crusted" notions. A stickler for modernity would condemn as hopelessly out of date a book which contains a remark about the "humidity" of damp coal carrying off a large portion of the "caloric" from retorts which have the misfortune to receive such undesirable charges. "Caloric" is, however, a favourite word with our author. In other matters, also, the Editor of Hughes is hardly up to date; nor has he always the firm grip of his subject which is indispensable when it is desired to strip it bare, so to speak, for the ready appreciation of the student. Thus he appears to confuse the question of the suppression of the dip in the hydraulic main with that of abolishing sealing in tar; and in doing so he apparently overlooks the fact that most dip-pipes are now-a-days sealed in liquor or water, and that the so-called "anti-dips" have dropped out of use, for considerations wholly disconnected with the tar in the hydraulic main. Upon the subject of retort furnaces, again, the information that Mr. Richards fails to give is very extensive. He does not illustrate or describe a single gas-furnace, although he admits that such furnaces are very economical of fuel and labour, which should be reasons, one would think, for paying particular attention to the type. Neither is the author's account of gas purification of a character to help a candidate to satisfy the Examiner in Gas Manufacture for the City and Guilds of London Institute. All that he has to say about the use of lime in purification is as follows: "In the ordinary method of purifying, the foul gas is admitted first into the purifier the most impregnated with impurity, thence it passes to the second, and so to the third, where the lime is comparatively clean. When purifiers are of ample magnitude, the foul lime, if properly moistened, remains an active agent in the purification to the last; therefore it is only when the gas begins to indicate signs of impurity at the fifth division, supposing six divisions of purifiers to exist, that they should be changed, and by the employment of apparatus of ample capacity only, can lime be employed to the best advantage." This is a fair specimen of the writer's method and matter. So in describing gasholders, he singles out for commendation a double-lift holder "such as are constructed in gas-works of the present day," which is as antiquated and unintelligent a sample of designing as could well have been discovered twenty years ago. And yet he knows of, and cursorily mentions, the later work in this line of Woodall, Livesey, Hunt, Gadd and Mason, and Pease! In short, this is an essentially out-of-date book, freshened up here and there, after a fashion, by a few sprinkling references to modern matters. It is not wholly destitute of useful information for a reader who is expert enough to pick it out; but it is without a trace of that critical, informing quality, which one is accustomed to expect in modern technical manuals. The best thing that the proprietors can do with their Hughes is evidently to "make pie" of him, and get him re-written by somebody who lives in the art of the present. It is not often that we find it necessary to condemn a technical work in this unsparing fashion; and it is always pleasanter to praise an author than to denounce him as useless. But this time we have no choice, seeing that we should proclaim ourselves incapable of doing our duty to the gas industry if we failed to characterize this bit of book-making as it deserves. Hughes is manifestly used-up.

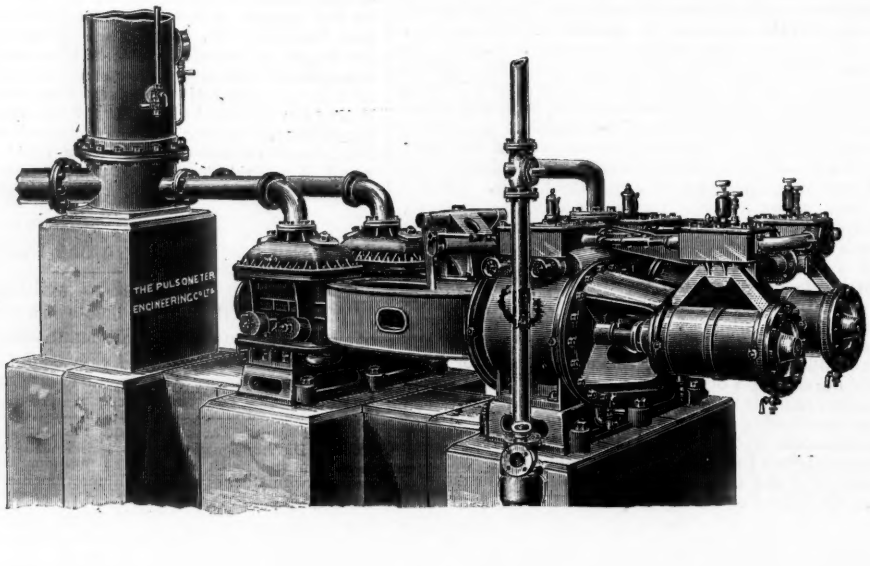
TECHNICAL RECORD.

THE DESTRUCTIVE DISTILLATION OF WOOD.

At the May Meeting of the London Section of the Society of Chemical Industry, the item of chief interest was a paper by Professor W. Ramsay and Mr. J. C. Chorley on the above subject. The data for the paper were obtained by the distillation of well-seasoned samples of oak, beech, and alder, in a glass retort immersed in an air-bath specially devised to maintain a uniform temperature. The delivery-tube of the retort passed through a Liebig's condenser; and the condensation products were received in a small flask, while the uncondensed gases passed on, through a tube containing pumice moistened with sulphuric acid to retain the vapour of methyl alcohol, and potash bulbs to remove the carbonic acid, to an aspirator where the volume of gas unabsorbed was measured. Prior to the heating of the retort, the whole of the apparatus was exhausted of air. In one set of experiments, the bath was heated to about 325° C.; and in another, to 500° C. The average charge weighed 170 grammes; and at the higher temperature it yielded 25 per cent. of charcoal, 60 per cent. of liquid distillate, and 10 per cent. of carbonic acid—the remaining 5 per cent. representing the weight of the other gases. The volume of gas received in the aspirator was 7 litres; and it had the following percentage composition: 73 measures of carbonic oxide, 20 of marsh gas, 1½ of olefines, 5 of nitrogen, and a trace of oxygen. At the lower temperature, the charcoal increased, and the liquid and gaseous products decreased in amount; the olefines being entirely absent from the latter, and marsh gas present in smaller proportion. From 7 to 15 per cent. of pitch, and 6 per cent. of acetic acid, were obtained from the liquid distillate. The temperature of the bath, as well as that of the interior of the retort, was observed; and it was found thereby that when the bath had reached 300° C., there was a sudden rise in the retort from 100° to 400° C. In an endeavour to accentuate the exothermic character of the change taking place, the author persistently styled it "explosive"—a scarcely justifiable extension of the meaning of that hardly-worked adjective. There appeared to be little variation in the products from the different varieties of wood experimented upon. The paper was discussed somewhat fully; but we need only refer to Professor Foster's remarks. He said that some years since he obtained figures which were at variance with those quoted above; but he used an iron retort, and the heat was admittedly much higher. He found in the gas only 25 per cent. instead of about 50 per cent. of carbonic acid; but he also found 18 per cent. of hydrogen, which Professor Ramsay believed to be entirely absent. The amount of carbonic acid, taken at even the lowest estimate, would apparently render the gas almost valueless for illuminating purposes, though it has been used in places where coal and oil are scarce.

PUMPING-ENGINES FOR WATER-WORKS.

On several previous occasions we have called attention to the appliances which the Pulsometer Engineering Company, Limited, of the Nine Elms Iron-Works, make a speciality of their business. Apart, however, from plant intended for the filtration of water on a large scale, they devote considerable care to the construction of direct-acting pumping machinery adapted for every possible service. This is amply demonstrated in a catalogue we have lately received of the Company's productions in this branch of engineering, comprising various forms of the "Deane" and other pumps,



as well as compound condensing engines particularly suited to water-works requirements. It is unnecesary to here deal with the characteristic features of the several appliances illustrated and described in the catalogue; we simply give one sample of the Company's work in the direction just indicated. The accompanying drawing represents a set of compound duplex condensing pumping-engines just sent out by them for a water-works in India—being the second order received from the same town. The high-pressure cylinders are 13 inches, and the low-pressure 26 inches in diameter, with a 24-inch stroke; and the pumps are 8-inch. The condenser is not shown; but it stands at the side of the foundation-stone—the pipe leading to it, with the valve, being given. It is of the "jet" type, of the Company's improved independent class. The pumps are of the latest pattern, fitted with lever motion, and specially constructed for working with considerable economy against heavy pressure and long mains. The general design and arrangement of the machinery are such as to allow of long-continued action without excessive wear and tear or stoppage for lubrication. It will be seen that the entire plant is practically self-contained, and therefore only very light foundations are required. This is an important consideration in connection with the first cost of erection.

Godstone District Gas Company, Limited.—It will be seen, by an advertisement which appears in another part of the JOURNAL, that the above-named Company are inviting applications for their unissued capital. Since the works at Lingfield were opened early last year, the consumption of gas has considerably increased; and when those now in course of construction at Godstone are completed in the course of a few months, a further augmentation will necessarily result. The works have been designed and erected under the superintendence of Mr. Robert Fish, Assoc.M.Inst.C.E., the Company's Consulting Engineer, who has taken offices at No. 5, Great Winchester Street, E.C.

The Gasholder Catastrophe at the Dawsholm Gas-Works.—In the report of Her Majesty's Inspectors of Explosives (Colonels Majendie, Ford, and Cundill) for the past year, reference is made to the explosions which took place at the Dawsholm Gas-Works on Jan. 15, 1891, by which, as may be remembered, two large gasholders were destroyed, and a man sustained somewhat severe injury by burns. The matter formed the subject of a prolonged inquiry by Colonel Ford; and the Inspectors say the result left no reasonable doubt that the case must be ranked with other malicious attempts of a like character—notably the outrage at the Tradeston Gas-Works at about the same period of the year 1883. No public advantage, the reporters say, would result from the publication of the details of the explosion, or of their conclusions as to the amount and nature of the explosive employed, and the method of its application. These points are fully dealt with in a "confidential" report on the case. Owing mainly to some secondary effects, the damage to property was, unfortunately, rather considerable.

The New Electrical Term.—Reference was made in the JOURNAL last week to the new term which will be introduced into the Electric Lighting Orders of the present session. In the schedules to the Orders, it is specified that the "kelvin" shall mean the energy contained in a current of 1000 ampères flowing under an electro-motive force of one volt during one hour. Where the undertakers charge any consumer by the actual amount of energy supplied to him, they are to be entitled to charge him at the following rates per quarter: For any amount up to 20 kelvins, 13s. 4d.; and for each kelvin over 20 kelvins, 8d. Where they charge by the electrical quantity contained in the supply, they will be entitled to charge according to certain rates set forth. The *Electrical Review* is by no means satisfied with the change, and asks when the "absurd fashion of re-christening" is likely to cease. Our contemporary thinks the Board of Trade unit is perfectly well understood under its present appellation; and does not consider its new name to be complimentary either to Sir William Thomson, or redounding to the good sense of those who have forced it upon the public.

The Coal Output of the United States.—In the JOURNAL for the 3rd inst., we gave some statistics of the iron and steel production of the United States. The following figures relating to the output of coal last year will be of interest in connection therewith. The total production amounted to 141,229,513 tons. Of this quantity, 45,600,487 tons were anthracite—all from Pennsylvania, except 2000 tons from New England and 53,117 tons from Colorado and New Mexico. The bituminous product yearly is about 95,625,000 tons, or more than twice that of anthracite. The annual output was nearly doubled in ten years. The coal industry furnishes employment to 300,000 persons, to whom $110,000,000 are paid in wages; and the capital invested is estimated at $350,000,000. The output of the different States is as follows: Pennsylvania, nearly 82,000,000 tons; Illinois, 13,000,000 tons; Ohio, 10,000,000 tons; West Virginia, 7,000,000 tons; Iowa, 4,500,000 tons; Alabama, 4,000,000 tons; Maryland, Indiana, Kentucky, and Missouri, 3,000,000 tons; and Tennessee, 2,000,000 tons. Other States have a smaller output. More than 25 per cent. of the freight of the country is coal. The average price per ton of coal at the mines was 99c. for bituminous and $1·44 for anthracite.

REGISTER OF PATENTS.

Gas or Carburetted-Air Engine.—Boult, A. J.; communicated from L. F. Lavasseur, of Evreux, France. No. 9006; May 27, 1891.

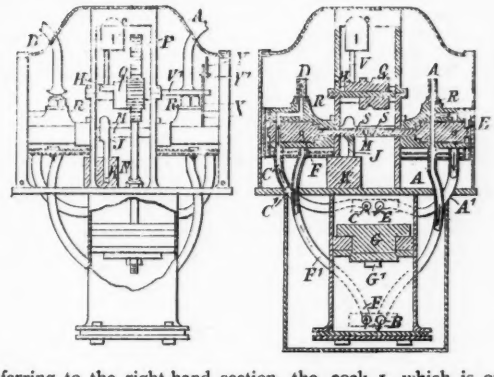
This invention relates to motors or engines operated by means of gas, petroleum, and the like; and it consists in the arrangement of (1) A compound valve for the admission and mixing of the air and gas in predetermined proportions for the purpose of obtaining the explosive mixture in the cylinder; (2) A piston adapted to work between the bottom of the cylinder and a spring-controlled counter-plate or diaphragm, enabling the lighting of the explosive mixture to take place in the centre of the cylinder through the agency of a tube made incandescent by Bunsen or other suitable burners; (3) A hammer or spring-controlled governor raised by a cam adapted to automatically open the mixture admitting-valve or not, according as the speed is above or below the normal standard; (4) A lighting-piston or slide-valve, which may be utilized simultaneously for lighting and distributing the charge (chiefly intended for motor engines of less than 12-horse power with the pressure counterbalanced upon the counter-plate); (5) A petroleum-pump with a plunger, operated by the governor, and automatically distributing the supplies of petroleum required for the production of the petroleum vapour necessary for each operative stroke of the motor piston; (6) A petroleum vaporizer or atomizer with a hollow spiral arranged around an escape-pipe; and (7) A gas chamber mounted upon a pipe of large diameter, with a small gas-pipe arranged within for the Bunsen burner.

Gas-Producers.—Bromilow, J., of Pontymister, Mon. No. 11,416; July 4, 1891.

The first part of this invention relates to the application of steam and atmospheric air in the production of producer gas as used for the raising of high temperatures in regenerative and other furnaces; and it consists in an arrangement of valves in two sets, so that the largest possible amount of steam can be decomposed in proportion to the quantity of fuel used, so as to effect a considerable saving in fuel and labour. The second part of the invention consists in an improved construction of the bottom of the producer, by dividing it into two parts by a brick wall, which is carried up a few inches above the door-frames, thus forming two separate pockets at the bottom, and a little below the level at which the mixed gases enter and come in contact with the solid fuel with which the producer is filled.

Water-Meters.—Haddon, R.; communicated from A. E. Balaciart, of Barcelona, Spain. No. 1465; Jan. 25, 1892.

As shown by the accompanying illustration (vertical sections at right angles to each other), this invention consists principally in the valve mechanism, by which the water is let into the upper and lower part respectively of a cylinder, so that the movement of the piston therein may be utilized to measure the quantity of water which has passed into the cylinder. As completed, the apparatus is enclosed in a casing of light galvanized iron with inlet and outlet for the water-pipes, and a series of dials of the counter on its face, covered by a glass window or other suitable means.



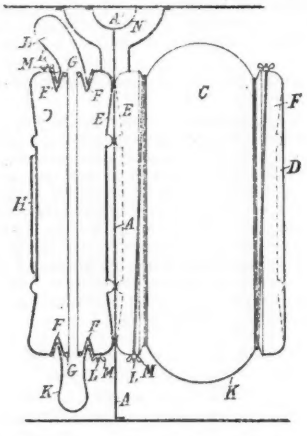
Referring to the right-hand section, the cock 1, which is of the rotary kind, is provided with two passage-ways in different planes, so that in the one position of the cock water passes from the inlet A to the inlet-pipe A^1, which issues at B into the bottom of the cylinder G^1; and in the other position, it passes from A to the inlet-pipe E, by which it enters the upper part of the cylinder at E^1. On the other side, in the same axial line with the cock 1, is the outlet-cock 2, which has likewise two passage-ways in different planes; so that, in the one position of the cock, the water may pass out from the upper part of the cylinder at C through the pipe C^1 into the outlet D, and, in the other position of the cock, the water may flow from the lower part of the cylinder at F into the pipe F^1 to the outlet D. The spindles S of the two cocks are connected together by the sleeve M, which carries a two-armed or balance lever J. This sleeve, therefore, if turned by a movement of the lever, operates both cocks simultaneously; so that the water passes alternately into the upper and lower parts of the cylinder, and the water previously therein flows out simultaneously alternately from the lower and the upper space—that is to say, the spaces on the opposite sides of the piston G in the cylinder G^1. This piston is packed with felt to slide easily in the cylinder. The piston-rod N passes through a stuffing-box O, and carries the rack P with rack teeth on each face; the one set of teeth gearing with the pinion T by which the counter is operated, the other set engaging with the pinion Q carrying on its side the tappet H. As the piston moves under the pressure of the incoming water, the pinion is revolved in the corresponding direction by the rack P. The tappet moves the arm V of the hammer I, and lifts it until the latter overbalanced falls upon the lever J, and rocks the lever against the rubber buffer block K, just as the piston

arrives at the end of its stroke. This action rocks the cocks; and the inlet of water is changed to the other end of the cylinder. The piston then moves back; and the pinion Q, with the tappet H, rotating in the contrary direction, again lifts the hammer until it is overbalanced and falls on the other arm of the lever, returning this lever, and with it the cocks, to the previous position.

The delivery of the cylinder being known—for instance, one gallon for each double stroke—the counter is correspondingly made. On the shaft V^1 of the pinion T is the disc X with the pivoted balanced or spring pawl Y thereon. As the disc revolves back and forth with each stroke of the piston G, this pawl moves the ratchet-wheel Z through the distance of one tooth. The train of wheels Z^1 gives the multiples of 10; each wheel revolving at one-tenth the speed of the previous wheel in the series. The arbors of the wheels Z carry the index fingers, which indicate the sum on the dials of the counter.

Dry Gas-Meters.—Wright, F., of Little Queen Street, Westminster. No. 3556; Feb. 23, 1892.

The object of this invention is to provide means whereby the leathers of dry gas-meters may be more easily attached to the metal heads or discs and rims than by the present method of wrapping with wire or tring, and also to do away with the soldered joints now used.



The illustration shows a view (partly in section) of the bellows of a dry gas-meter constructed according to this invention.

A is the partition, and A^1 the gas-inlet; and B C, the bellows, whereof the former is shown in section. D is the outer, and E the inner head, which is secured to the partition by solder or other suitable means. The heads D and E are pressed or stamped from sheets of metal, and afterwards spun over a suitable mould to form the V-shaped groove F therein. To prevent the edges of the heads from cutting the leathers, they should be beaded as at G, or they may be simply turned over to a right angle. The heads may also be strengthened, when required, by corrugating or dishing the same, or by dishing and corrugating as shown.

The patentee prefers to form the moving head D with a hole in the centre, through which is introduced an inflated bag or mould, over which the leathers are stretched. When the leathers are secured, the mould is removed, and the hole is closed by a patch-piece H soldered to the head D. To secure the leathers K to the heads D and E, the inflated mould is placed in position between the heads, the leather is stretched over it till quite tight; and, when tight, the leathers are drawn into the grooves F by flexible wires or strings. One end of each wire or string is secured to the studs L (which are attached to the heads D E), and two or more convolutions of the wire or string are passed round the leather—sufficient tension being kept on the wire to draw the leather well down into the grooves. The other end of the wire or string is then twisted or tied round the stud L, and cut off; a nut M being placed on the stud, and screwed down tight on to the wire or string. By this means a perfectly gas-tight joint is made between the leather and the head, with a minimum expenditure of labour. It is only necessary to tack the heads E to the partitions in about four places, and connect by means of a small channel-pipe N to the proper port in the corresponding valve.

Gas-Burners.—Johnson, J.; communicated from H. Kennedy, of Sharpsburg, Penn., U.S.A. No. 3958; March 1, 1892.

This burner is specially devised for burning blast-furnace gases in the furnaces of steam-boilers, &c. It consists of a combination of a gas-blast producing apparatus, a delivery-pipe leading therefrom of substantially as large area as the burner to which it leads, an open-mouthed burner at the termination of the delivery-pipe, wide in one dimension and relatively thin transversely, a furnace into which the burner leads, and an air-inlet space around the burner.

Electric Gas-Lighting Burners.—Pinkham, G. F., of Norfolk, Mass., U.S.A. No. 4610; March 8, 1892.

This invention relates to electric gas-lighting burners; and it has for its object to improve the construction of these appliances, and render the lighting device more durable, reliable, and positive in its action, and at the same time avoid the liability of its getting out of order. To this end, it consists in the combination with the plug of the stopcock, arranged vertically within the shell and provided with a thumb-piece or handle, and the pillar or vertical portion forming a prolongation or upward extension of the plug, of a fixed and a moveable electrode composed of a pin or rod having a suitable terminal, and sliding within a guide attached to, and adapted to be rotated with, the pillar. There is also a cam for raising the rod as its lower end is caused to travel in contact therewith, by the rotation of the pillar to carry it terminal above the level of the terminal of the fixed electrode. The cam has two inclines, one outside the other, extending upwards in opposite directions, and adapted to act alternately upon the rod, and a spring for retracting the rod after it has passed off the end of the upper incline of the cam.

APPLICATIONS FOR LETTERS PATENT.

7753.—Morrison, J., "Ejectors for ejecting water, thick or thin, or tar and ammonia water." April 25.

7800.—Clark, J., "Safety gas-cocks." April 26.

7888.—Stringfellow, J. H. W., "Distillation of coal and other substances for gas making and other purposes, and apparatus therefor." April 26.

7923.—Foulis, W., "Regulating the flow and pressure of gas." April 27.

7983.—Dvorkovitz, P., "Manufacture of gas for illuminating or heating purposes; applicable also for the distillation of liquid hydrocarbons." April 27.

7995.—Bayley, J. P., "Charging inclined gas-retorts." April 28.

8112.—Rock, T. D., "Gas generators." April 29.

8129.—Normanton, T. G., "Lamps and apparatus and appliances for distributing and lighting with petroleum." April 29.

8207.—Hawkins, W. and T., and Fuller, H. and W. H., "Metallic block to be used in the production of gas." April 30.

8279.—Milne, J., "Applying gas-bags to gas-mains and the like." A communication from E. Borias. May 2.

8298.—Phillips, W., "Gas regulator for maintaining required temperatures in greenhouses, rooms, ovens, &c., where heated by gas." May 3.

8349.—Ryland, F., "Cast-iron burners for lamps." May 3.

8365.—Newton, P. A., "Tapping water-mains, and forming branch connections therewith under pressure." A communication from H. H. Burritt. May 3.

8382.—Andrew, W., "Socket and spigot pipes." May 3.

8401.—Pollock, G., "Gas-engines." May 3.

8410.—Hawkyard, J., and Braddock, J., "Supplying gas or other fluid on prepayment." May 3.

8426.—Longsdon, A., "Manufacturing gas from water vapour, and purifying and separating mixed gases." A communication from F. Krupp. May 3.

8462.—Bayle, P. H., and Cambray, A., "Distillation, heating, and condensation of bituminous schists, and any mineral substances which by distillation in closed vessels will yield mineral oils, paraffins, ammoniacal waters, and analogous products." May 3.

8540.—Rohovszky, J., "Automatic igniting device for gas-burners." May 5.

8542.—Twigg, R. H., "Liquid-meters." May 5.

8592.—Leveritt, T. D. C., "Purification of coal gas used for the purposes of heating and cooking." May 6.

8635.—Moberly, C. H., "Engines worked by a mixture of gas or hydrocarbon vapour and air." A communication from E. A. Yakovleff. May 6.

8649.—Money, F. J., "Water motor." May 6.

8665.—Rylands, D., and Emmet, C., "Pressure-regulating valves for highly-compressed gases." May 7.

Three Yorkshire Water Schemes.—Three water-works schemes of some importance are being carried out in different towns in Yorkshire. The first in point of time, and the most important in the matter of expenditure, is that of the Yeadon Water Company, who are constructing on a part of Hawksworth Moor a new reservoir with a storeage capacity of 92 million gallons. The first sod of the reservoir was turned on Feb. 8, 1890; so that the work has now been in progress for more than two years, and it is not expected that it will be finished before the end of the present year. This and other work which the Company are proposing to carry out is estimated to cost £28,000. The second scheme is that of the Baildon Local Board, who are greatly enlarging the area of their gathering-ground, and forming an additional reservoir, also on Hawksworth Moor. Parliamentary powers were obtained in 1890 for the scheme, which involves an outlay of £16,000. A start was made with the work in May, 1891; and it is expected that another year or more will be occupied in its completion. The third scheme is that of the Shipley Local Board, who are laying down a new high-level service, to enable them to reach the highest altitudes of their diversified district, and constructing filter-beds for dealing with the domestic supply. The expenditure for this work is computed at £10,000.

The Wexford Gas Consumers' Company and their Coal Supply.—In the High Court of Justice, Ireland, last Wednesday week, a case came before Mr. Justice Holmes and a special jury in which the Wexford Gas Consumers' Company sought to recover £300 damages for an alleged failure on the part of the Walker Coal Company, Limited, to supply coal according to contract. The case of the plaintiffs was that the defendants agreed to supply them with gas coal, not exceeding 3000 tons within a fixed time, at the price, for the first year, of 5s. 6d. per ton, less 2½ per cent., and for the second year of 6s. per ton, to be shipped at Newcastle-on-Tyne, and the vessels to be chartered according to the requirements of the plaintiffs, they paying costs. The defendants, it was alleged, after having delivered 815 tons of coal, refused to supply the rest of the quantity contracted for. Plaintiffs further alleged that, in consequence of a rise in the price of coal (after the making of the contract) to 8s. 6d. a ton, they had suffered considerable loss. The defence was a denial of the contract as stated by the plaintiffs; a plea that it was a term of the agreement, and condition precedent to the supply of the coal, that the plaintiffs should provide vessels for the carriage of it, but that they had failed to do so; that there was a further condition that the defendants should only be required to supply a reasonable portion of the coal from time to time, which they had been willing to do; and the defendants counterclaimed for £500 in respect of loss caused to them by the refusal of the plaintiffs to accept the remaining 2185 tons of coal. The hearing of the case occupied two days, when the jury found for the defendants in the original action, and against them on the counter-claim.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Supporting Inclined Retorts.

SIR,—With reference to patent No. 9310, published in your issue of the 10th inst., I desire to point out that, so far as it relates to "an improved method of supporting retorts which are set at an angle to the horizontal line," it has been anticipated by patent No. 5078, dated April 1, 1890, taken out by myself, and published in the JOURNAL for March 24, 1891. Retorts corresponding to your illustration were in course of manufacture under my directions prior to the date upon which this later patent appears to have been applied for.

Birmingham, May 14, 1892. CHARLES HUNT.

The Present Position of the Gas-Works Rating Question.

SIR,—I have read Mr. Humphry's reply to the comments contained in my letter of the 28th ult., and confess that I do not understand it.

I take it, however, from its general drift, that he adheres to his previous statement that "the law lays down, as a first principle, the rule that the rateable value shall be equal to the rent which a tenant would be willing to give for the property from year to year." Now I repeat that this is inaccurate, and therefore misleading.

Although we are all (or most of us) agreed as to the urgent need for some improvement in the law of rating—especially as applied to gas and water undertakings—it is well, in the meantime, to accept the interpretation as we find it; and all the more so as it is quite clear and precise. Permit me, then, to quote the definition of gross value and rateable value, as given in "The Valuation (Metropolis) Act, 1869."

"The term 'gross value' means the annual rent which a tenant might reasonably be expected, taking one year with another, to pay for a hereditament, if the tenant undertook to pay all the usual tenant's rates and taxes, and tithe commutation rent-charge, if any; and if the landlord undertook to bear the costs of the repairs and insurance, and the other expenses, if any, necessary to maintain the hereditament in a state to command that rent." "The term 'rateable value' means the gross value after deducting therefrom the probable annual average cost of the repairs, insurance, and other expenses, as aforesaid."

Manchester, May 13, 1892. THOMAS NEWBIGGING.

Should External Guide-Framing be Abolished?

SIR,—My attention has been drawn to the publication, in your last issue, of Mr. Livesey's report to the Salford Corporation on the above question.

It is by no means surprising that a gentleman in Mr. Livesey's responsible position should feel it imperative upon himself to take up an attitude of extreme conservatism and caution, in considering a subject or proposal of so radical a character as the entire abolition of the upper guide-framing of gasholders. Indeed, I think it shows Mr. Livesey's characteristic fairness when he so frankly admits that holders up to a certain size may be erected with spiral guides or otherwise, without framing, with perfect safety. His want of confidence is confined to large holders, which, he has recently informed us, commences at about 150 feet diameter, and which, of course, would include the proposed holder at Salford.

Believing myself, most sincerely, that large holders constructed on the spiral system are, relatively, safer than smaller ones, I should like to see a way out of the apparent deadlock produced by the following words in Mr. Livesey's report, wherein he says: "It would be wrong to run any risk until the doubt is completely and satisfactorily removed." If this doubt in Mr. Livesey's mind can only be removed by *experimental* demonstration, with a large holder, it would appear that he must think it wrong to make such experiment to enable us to remove the doubt. On the other hand, if Mr. Livesey intends by these words, that the doubt may be satisfactorily removed *theoretically*, it would give me the greatest pleasure possible to have the privilege of meeting him in friendly discussion for the purpose of thoroughly thrashing the matter out.

I expect before long to be able to point to, amongst a number of others, holders in successful operation of three lifts, constructed on the spiral system, of 90 and 100 feet diameter respectively; but, of course, these will not reach the dimensions of what Mr. Livesey considers truly large holders. Nevertheless, I am hopeful, ere long, that we shall be able to find some engineer, either in this country or abroad, who will have the courage to erect one which shall reach very much larger dimensions; and I firmly believe if Mr. Livesey and myself are happily spared to a reasonable age, we shall live to see holders of the largest dimensions constructed on this system, when, I am perfectly sure, that gentleman will be one of the first to congratulate me upon the fact.

I should well like an opportunity of demonstrating to Mr. Livesey that his illustration of the inverted wicker waste-paper basket is not really analogous to a gasholder, with regard to its relative capability of resistance. This may be proved by an experiment I have made upon a model gasholder, constructed of very thin tin, without any stays or bracing of any kind—nothing but the simple cylinder domed over, and attached to supports at the base. I subjected this to an uniform horizontal pressure, over the whole semi-circular surface, in one direction, of 628 lbs. to the square foot of the equivalent plane, before any permanent set (and that of a very slight character) could be produced.

It is well known that I draw a great distinction between the method of guiding by means of spiral guides, twisting the holder in its ascent and descent, and the method of vertical guiding by means of rope gearing; and, although I claim to be, *de facto*, the first and true inventor of both systems, I readily admit that safety with the latter system decreases as the diameter of the holder increases, and is therefore suitable for the smaller class of holders; whilst with the former I assert that safety is increased with the increase of diameter, thus rendering it specially applicable to the largest possible sizes.

It is a mistake to suppose that, in the spiral-guide arrangement, there is any difficulty in fairly equally distributing the strain over all the points of support, as I hope very soon to have an opportunity of demonstrating.

With regard to wind storms, we have certainly had some very respectable ones during recent years; and the behaviour, under heavy wind pressure, of the spirally-guided columnless gasholders already erected, has been in every way satisfactory, and entirely free from that unpleasant vibration observable in holders guided in the old manner, which I am sanguine enough to believe will in time become obsolete.

Manchester, May 13, 1892. W. GADD.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time: Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3).

Bills read a second time and committed: Brynmawr and Abertillery Gas and Water Bill; Mold Water Bill; Ormskirk Gas Bill; Southend Gas Bill; Stamford and St. Martin's Stamford Baron Gas Bill.

Bill referred to a Select Committee, consisting of Earl Ducie (Chairman), Viscount Powerscourt, Lord Churchill, Lord Wimborne, and Lord de Vesci; to meet on Tuesday, May 17: North Shields Water Bill.

Bills referred to a Select Committee, consisting of the Marquis of Bath (Chairman), the Duke of Leeds, Lord Herries, Lord Monckton, and Lord Cheylesmore; to meet on Thursday, May 19: Brynmawr and Abertillery Gas and Water Bill; London County Council (Subways) Bill.

Bills reported, with amendments: Uttoxeter Water Bill; Newport Corporation Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time and committed: Gas Provisional Orders Bill; Tredegar Local Board Water Bill.

Bills referred to a Select Committee, consisting of Sir Joseph Pease (Chairman), Lord F. Hervey, Mr. W. M'Arthur, and Mr. Victor Cavendish; to meet on Thursday, May 19: Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill; Bradford Corporation Water Bill; London Water (No. 1) Bill; Rhymney Valley Gas and Water Bill.

Bills reported, with amendments: Cleator Moor Local Board Gas Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3).

Bills read the third time and passed: Barrow-in-Furness Corporation Water Bill; Bournemouth Improvement Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Oxford Gas Bill; Rhyl District Water Bill.

Petitions have been presented for the Bexhill Gas and Water Bill, and for an additional provision in the Exmouth and District Water Bill. The former is under the consideration of the Standing Orders Committee; and the latter has been granted by the Committee.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.
Wednesday, May 11.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* LINDLEY *and* KAY)

The Attorney-General (at the Relation of the Mayor, &c., of Tynemouth) v. North Shields Water-Works Company.

This was an information and action claiming an injunction to restrain the defendants from supplying to the Corporation of Tynemouth and the inhabitants of the borough water which had been pumped from the Shiremoor Colliery or any other colliery workings, or water which was impure or unfit for domestic use. The defendants were incorporated by an Act of 1786 for the purpose of supplying fresh water from any "spring, stream, or pond" to Tynemouth; and by an Act of 1866 they were compelled to supply water for domestic purposes. The Company were, until 1883, in the habit of taking a large quantity of water from a well about a mile from an old working in Shiremoor Colliery. This working was full of water; and in 1883 the colliery-owner began pumping it out—causing the well to become dry. The water from the working was pumped into a culvert, and it then flowed into a stream. The Company thereupon took the water pumped out of the colliery at the place where it entered the stream; this water in wet seasons forming half the bulk of the stream. At the trial before Mr. Justice Wright and a special jury, evidence was given that the water was impure, and not fit for drinking purposes. The learned Judge granted an injunction substantially as prayed (see *ante*, p. 585). The defendants appealed.

Mr. LAWSON WALTON, Q.C., appeared for the appellants; Mr. TINDAL ATKINSON, Q.C., and Mr. T. WILLES CHITTY, representing the respondents, were not called upon.

The MASTER of the ROLLS, in giving judgment, said the Company had compulsory powers to obtain fresh water from "springs, streams, or ponds," and to supply that water to the inhabitants of Tynemouth. The Company would not be justified in obtaining and supplying water from any other source. If they exceeded their powers, the Attorney-General could interfere to stop them, though he probably would not do so if the water supplied was good. The evidence here showed that

the water was impure. The Corporation also were parties to the action, in order to protect the inhabitants; the duty of the Company being to supply water fit for domestic purposes. The Company took the water pumped out of the shaft of the mine, and supplied it to the town. The water did not come from a "spring, stream, or pond;" therefore it came from an unauthorized source. The water was also impure, and unfit for domestic purposes. The injunction, therefore, which was confined to the water coming from this old colliery working, was rightly granted.

The LORDS JUSTICES gave judgment to the same effect.

The appeal was therefore dismissed.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, May 9.

(*Before Justices* DAY *and* CHARLES.)

East London Water-Works Company v. Kellerman.

This was an appeal by the plaintiffs from the decision of the County Court Judge sitting at Bow, in an action brought to recover 14 quarters' rate, amounting to £3 6s. 6d., for water supplied to the defendant. The latter paid into Court the sum of 9s. 6d., being the rate for the last two quarters; but he denied liability as to the remainder. The case raised an important question as to the liability of the owner of a house in respect of arrears of rates which had accrued due before he became owner, and while he was tenant and occupier; the premises being under the annual value of £20.

Mr. DARLING, Q.C., and Mr. H. KISCH (instructed by Messrs. George Kebbell and Miller) appeared for the plaintiffs; Mr. SETH SMITH and Mr. PERCEVAL represented the defendant.

Mr. DARLING, in opening the appeal, said that from the 16th of January, 1889, the defendant held the premises in respect of which the rate was incurred as a lessee under an agreement, and he covenanted to pay all the rates, including the water-rate. On the 1st of July, 1891, there was a conveyance of the freehold to the defendant; and on the same date a mortgage of it to the House Owners' Association, by which he was to pay by instalments the price fixed under the conveyance. He made default in his payments; but the County Court Judge found that the mortgagees did not take any advantage of this. He therefore decided that, by reason of the existence of the mortgage deed, the defendant was not the owner of the premises within the meaning of the Water Companies (Regulation of Powers) Act (50 and 51 Vict., cap. 21, sec. 4), and that the Company were not entitled to recover.

Justice DAY: Do I understand the decision to be that a mortgagor in possession is not liable to pay water-rate?

Mr. DARLING said the Judge had decided that the defendant was not liable, because he was not the owner under the above-named Act. The Company could not cut off the water; but they had a right to recover the rate due in respect of the house. The other side contended, however, that the Act gave the Company a charge on the property, with interest at 5 per cent.; and the only remedy was, not to recover against the owner or occupier for the time being, but to commence a suit in the Chancery Division.

Justice DAY: It comes to this, that if you have bought premises, and have not the means of paying for them, you are not liable; but if you have the money to pay for them, you are liable.

Mr. DARLING: Quite so. If the defendant had not mortgaged the premises, he would have been bound to pay under Mr. Forrest Fulton's Act.

Justice CHARLES asked why the defendant was not to be responsible as tenant.

Mr. SMITH said because the rateable value of the house in question was under £20.

Justice CHARLES: What you say is that, having become the owner, you accept the responsibility put upon an owner by the Act of Parliament, but you are not liable as tenant before then.

Mr. DARLING said the County Court Judge thought the defendant would have been liable had it not been for the mortgage.

Justice DAY said the real question was whether, by reason of a conveyance executed in July, the defendant became liable for water-rate which had accrued previously.

Mr. DARLING thought that was so. He submitted that the defendant was the owner for the time being, and consequently liable.

Justice DAY: Does it not become a charge upon the land?

Mr. DARLING said the defendant would have been liable if he had been sued in the Chancery Division. Before the defendant bought the property, there was a charge due upon it for unpaid water-rate for which he became liable.

Justice DAY: Suppose he had been a stranger, and bought the property with the charge upon it.

Mr. DARLING: He would have been liable to pay it.

Justice DAY: You wish to seek to convert a charge upon land into a personal liability?

Mr. DARLING: No; I say the Act has given me both remedies—a charge upon the land, and a charge as against the person owning the land.

Justice DAY: There was always a liability on the person. The old owner was always liable to pay the rate.

Mr. DARLING: For the water which he had received.

Justice DAY: The present defendant did not become the owner till July. He buys the land subject to the charge; but it does not transfer to him a personal liability against the old owners.

Mr. DARLING: I submit that, by section 4 of the Act of 1887, all liability is put upon him.

Justice DAY: Suppose he had bought the property at the Auction Mart, do you say he would be liable for these charges?

Mr. DARLING: He would be liable to an action for their recovery.

Mr. SMITH contended that the Act had not enlarged the powers of water companies, though undoubtedly it gave them a charge for water-rate on certain property which they could not, in the ordinary way, recover from the occupier. As the rateable value of the property was under £20, the only right of personal action was against the owner.

Justice DAY: Are the Company bound to supply water to a new tenant if the old rate is not paid?

Mr. SMITH said he thought they were; and, in support of his contention, he cited the case of the *Sheffield Water Company v. Wilkinson*,* in which it was decided that there was no lien for water-rate.

Justice DAY asked whether arrears were a charge upon the land.

Mr. SMITH submitted they were not. They could only be a charge so far as the rates were due from the owner.

Justice DAY, in giving judgment, said the action was an appeal from the decision of a County Court Judge, who had held that the defendant, although chargeable with some portion of his water-rate, was not liable for the remainder. It appeared that he was formerly the tenant of the premises in question, of which the rateable value was under £20; and therefore he was not personally liable for the water-rate. The owner of the premises for the time being—the person who received the rent—was by statute liable. In the month of July, 1891, the defendant altered his position from being tenant, as he bought the reversion of the property. He did not, however, pay for it, but borrowed money to enable him to do so; and for the purpose of raising this loan, he effected a mortgage. He still remained in the premises as mortgagor in possession, though this fact was entirely immaterial to the case. The defendant disputed his liability to pay the rates which accrued during his tenancy; and no doubt, *qua* occupier, he never was responsible for them. But it was said that, by reason of the subsequent purchase of the reversion, he had made himself liable, simply because he had become the owner of the premises. Prior to 1887, the Company had a remedy in respect of unpaid rates by cutting off the supply of water; but Mr. Forrest Fulton's Act specified that from thenceforth they should not do this. To compensate them for the deprivation of this power to recover rates due to them, the statute provided, by section 4, that where the owner, and not the occupier, was liable by law (which was the case here) for the payment of the water-rate, such rate, without prejudice to the other remedies for enforcing payment, should be a charge on the dwelling-house in priority to all other charges affecting the premises. Therefore, by force of this enactment, the water-rate, being unpaid, became a charge upon the premises. The statute went on to provide that the amount might be recovered, with costs, from the owner or from the occupier for the time being, in the same manner as water-rates might be recovered by law. It was said that the defendant (who, no doubt, had been tenant or occupier prior to July, 1891), by acquiring the reversion in July, became subject to an action in respect of the arrears, because the Act went on to provide that "the amount may be recovered, with the costs incurred, from the owner for the time being, in the same way as water-rates may by law be recovered." This would be unnecessary if it only applied to the person who was originally liable, because the owner always was liable to be sued in respect of water-rates. The Legislature, when making the water-rate a charge on the premises, specified that the owner for the time being might be proceeded against. It then provided in the case of the occupier, where he was made liable that he should, after certain notice given to him, pay the water-rates to the supplying company, and deduct them from the rent payable to the landlord; that was to say, it was a mode of enforcing, through the occupier, payment of the charge on the land—making him pay to the water company money which otherwise he would have paid to the landlord. The landlord bought the property for so much less, because there was a charge for water-rates upon it; and he was liable to pay off this charge. He was not to be proceeded against by tedious suits in equity; but the supplying company could compel the occupier to stop the amount out of the rent. If the occupier would not do it, he was liable to be sued, although in the first instance he was not liable for the rates, and never was. Afterwards the company might enforce payment against the owner for the time being, through the medium of the tenant or occupier for the time being. In the case where the owner was originally liable, the rate was a charge on the land; and where there was a tenant, the supplying company could proceed against him, and make him pay, and deduct the amount from the rent. If there was no tenant, or it was otherwise more convenient, the company might enforce the charge on the land. For these reasons he thought the Judge in the Court below had erred, and that judgment ought to be entered for the plaintiffs, with costs.

Justice CHARLES concurred.

Mr. SMITH asked for leave to appeal.

Justice DAY said that, although the sum in dispute was small, the matter was one of general importance; and therefore he would give leave to appeal.

Pocklington Water Company's Provisional Order.—With respec to the application made by the Pocklington Water Company, Limited, for a Provisional Order empowering them to divert water flowing into the stream which runs through Pocklington, Major Marindin, who recently conducted an inquiry into the Company's proposals, reports that the existing source of supply cannot be considered satisfactory, owing apparently to the manner in which the reservoir is constructed and that the supply from this source is liable to decrease, owing to the difficulties of collection. There is, admittedly, an abundant supply of water on the hill where the reservoir is situated, if the difficulties of collecting it could be overcome; and it would be an undoubted advantage to the inhabitants of Pocklington to be able to obtain a better and more reliable supply, especially in view of a proper drainage scheme for the town. With such a small undertaking, however, the construction of a compensation reservoir, or the supply by means of pumping, is out of the question. The Company have, moreover, failed to show that all possible steps have been taken to make available the whole supply of water at the present source. Under these circumstances, and seeing that the amount of water in the beck is so small in the dry season that the abstraction of any of it would to a certain extent damage the millers, Major Marindin is unable to recommend that the application should be granted. On this report, the Board of Trade have decided not to grant the Order.

* See JOURNAL, Vol. XXXIII., p. 435.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Thursday, May 12.

(SECTION C.—*Present: The Right Hon.* A. J. MUNDELLA, M.P., *Chairman; the* DUKE OF DEVONSHIRE, *Mr.* AUSTIN, *Mr.* G. LIVESEY, *Mr.* TAIT, *Mr.* TUNSTILL, *Mr.* TOM MANN, *Mr.* MAWDSLEY, *and Mr.* TROW.)

Evidence Relating to the Gas Industry.

At the sitting of the above section of the Labour Commission to-day, witnesses were called to give evidence on matters relating to the gas industry.

Mr. *J. Taylor*, connected with the Sheffield branch of the National Union of Gas Workers and General Labourers, referred to the reduction of the hours of gas workers in Sheffield from twelve to eight; and on being asked by Mr. G. Livesey whether the men did not do as much work in the eight hours as they had previously done in the twelve, his reply was that this was just the argument they used in support of the reduction. When the stokers made their request for an increase of pay and fewer hours, their representatives were very fairly met; and although they did not get all they asked for, very considerable concessions were made.

Mr. *T. Blackburn* was the next witness examined. In answer to the CHAIRMAN, he said he was Secretary of the Greenwich branch of the Gas Workers and General Labourers' Union, which was in connection with the works of the South Metropolitan Gas Company. He appeared before the Commission to give evidence with respect to the strike at the South Metropolitan Gas-Works in 1889. At the time of the strike, there were a large number of men members of the Union—from 3000 to 4000 in Greenwich alone. Of these he thought there were now about 3000 financial members. The Union did not deal with wages and hours of labour only, nor did it confer any benefits. It was only to regulate the hours of labour. The members paid 2d. a week. The Union had been formed since April, 1889. The strike began on Dec. 13, 1889. It originated through some members of the Union at the Company's Vauxhall works having destroyed their cards and signed a profit-sharing agreement; but the real origin of it was the men applying to the Company for double time for all work done on Sundays. This was granted under protest. Before 1889 there was no double time on Sundays, and only occasional Sunday labour, when he was working for the Company. In the twelve months there was only one Sunday on which he had to work. It was agreed, however, by every member of the Union, or every worker throughout the Metropolis, that, if they had to work in gas factories on Sundays, they had a perfect right to be paid double time for it—to have two days' pay for one. When he worked on Sunday, he was paid time-and-a-half. There were demonstrations all over the Metropolis; and it was agreed by all who were in any way connected with the Union that the men had a perfect right to ask for it. A deputation attended at the Cannon Street Hotel, on the 4th of November; and the Chairmen of the different Gas Companies, and some of the Directors also, were there to meet the men on the subject. Nothing could be finally settled then; therefore they met again on the 13th. On that day the Chairman of the South Metropolitan Company did not attend; but he invited two delegates from each of the stations to meet him at the chief office, in the Old Kent Road. There they discussed the matter with the Directors and himself (witness). The other two Companies—The Gaslight and Coke and the Commercial—conceded double time for Sunday labour. There was a question in regard to three extra retorts being done; and this was also settled. The Union agreed that the men should do the three extra retorts, provided they were called upon, if they could not get other men, so as not to delay the work in any way.

The CHAIRMAN: So that practically you settled your dispute with The Gaslight and Coke Company and the Commercial Company, but not with the South Metropolitan Company?

Witness: We could not settle it with the South Metropolitan, because neither the Chairman nor anybody was there to represent them on the second occasion.

What happened with the South Metropolitan Company?—We met the Directors, and a profit-sharing agreement was drawn up and offered to us, which was to be considered at the same time. We delegates were an hour and a half discussing the agreement; but we could not see our way clear to signing it. I am speaking of the carbonizing department, because some of the other men, who were working in the yard signed it. After we had discussed the agreement, Mr. Livesey himself agreed that it would bear a little alteration. Mr. Livesey distinctly told us he thought it was very hard of us to act in the way we were doing; that we were never satisfied; that it did not matter what he granted to us, for a day or two afterwards we were coming again with some grievance. He said it was impossible for him to grant it; we had squeezed the orange till it was dry, and could not get anything more out of it. The General Secretary of the Union distinctly told Mr. Livesey that the men were determined that they would have the double time for Sunday; and if they did not get it, the result would be that they would have to send in their notices. Every one of us understood then that it would be but very shortly before it would come to a strike.

Up till that Monday they did grant the double time?—Yes, under protest, and that was just the same as saying "We grant it you under protest; but we shall have it back the very first opportunity." And it was not long before they did it, because, when the men at Vauxhall signed the profit-sharing agreement, the Executive of the Union wrote to the Directors on the 2nd of December, asking them if they would kindly remove those men, on account of their having torn up their Union cards, which was causing a disturbance among the other men.

What was the result?—The result was that 2000 of us gave in our notices; and we continued out until the 4th of February, 1890. On that day the strike was brought to an end—or rather it was agreed that it should be brought to an end—in consideration of the Company taking back the old hands in preference to strangers, provided we would bring the strike to a close officially. We did so, and four days afterwards there was posted up on the gates a notice that the Union men were not required; and they are not allowed to work there now. No man carrying the Gas Workers' Union ticket is permitted to work for the Company; and this is really the grievance we wish to bring before the Commission.

Do you say that a man employed by the South Metropolitan Gas Company can no longer be a member of your Union?—Not if they know it. Of the 2000 men who sent in their notices, some were taken back; but this was while the struggle was going on, and they had to leave the Union. They deserted from us when they went back.

Did half of them go back?—Oh, no; not a quarter of them. The best part of them are now walking about, doing nothing. One has gone to one place, and another to another.

They have not been idle ever since 1889, have they?—No; I am speaking really of the effect the strike had upon them. They had to go here, there, and everywhere. Those who have remained in Greenwich have not got much, I assure you.

Did you understand the profit-sharing scheme—under which you would have the same wages you had been previously receiving, and a bonus on division? Did you carefully consider that scheme?—Yes; I thoroughly considered it; and I believe the greater portion of the men did so likewise.

What was the objection to it, if it gave you the wages you had before, double pay on Sundays, and a share of profits besides?—It was that you entered into an agreement for one year—that was one clause which was very objectionable. Of course, providing we signed the agreement, we should not have required any Union whatever. We should have had nothing whatever to uphold, because we were already bound for a year, and that clause stated that, if at any time a man wished to leave, he must give notice to the Engineer, and he would give his answer within a month. Therefore after a man had once signed the agreement, it would ultimately come to this, that he must stop in the gas-works for the rest of his life, because no employer would keep a situation vacant for a month while a man was waiting to get the reply from the Engineer.

It required that you should give a month's notice to terminate the agreement?—No.

Mr. LIVESEY: You had better read what it was.

The CHAIRMAN: Give it to us in your own way.

Witness: The agreement was that you should apply to the Engineer if you wished to leave; and the Engineer would consider whether he could spare you, and you would have your reply within one month.

You could not give a month's notice to leave?—Oh, no; you would only be bound under the week's notice, by the way we were working.

Is there anything further you would like to state respecting it, or is that your whole story?—I should like to ask if I should be at liberty to give the reason why the Company really did break the agreement they entered into with us, that they would take back the old hands in preference to strangers, as vacancies occurred.

Had you that in writing?—Yes; that was an agreement entered into with Mr. Shipton, of the Trades Council, Mr. Thorne, and Mr. Ward. Mr. Livesey signed it on behalf of the Company.

Have you a copy of the agreement?—I have not; but you can have a copy of it. I daresay you will have it forwarded to you. I am not here on behalf of the Union. The men in Greenwich wished me to come and give evidence as to this strike; and therefore I do not hold these papers.

You have told us your own story respecting it; but the official story will be told by whom?—I believe by Mr. Thorne, the General Secretary; or Mr. Ward, the Assistant Secretary, is here, and he could tell it. He was working for the Company at the time I was—almost at the same time that the dispute arose.

Mr. TUNSTILL: I understand that the foundation of your grief and trouble lies in the fact that the Company did not take you back again, as you expected they would, and as they had contracted to do?

Witness: Yes; that is my principal grievance.

Mr. LIVESEY: Going back to the question of Sunday labour, you told us you had time-and-a-half. You remember, I suppose, the agreement that was come to in June, and you remember that a notification was put up. Perhaps you know it was the practice at one works to pay time-and-a-half?

Witness: Yes.

That notice is dated July 1, is signed by myself, and reads as follows: "For Sunday labour between 6 a.m. and 10 p.m., on the rare occasions when it would be necessary to work, time-and-a-half will be allowed at all stations." Then we come to your statement about the further demand. On the 23rd of October, this letter was written—perhaps you may know it; it is addressed to me: "Gas Workers and General Labourers' Union. Dear Sir,—I am requested by the Executive Council of the above Society to ask you for double time on Sundays from 6 a.m. to 10 p.m. An early reply will kindly oblige, yours respectfully, W. Thorne." Accompanying the letter was this notice: "National Union of Gas Workers and General Labourers of Great Britain and Ireland. Council meeting held at the Registered Office, Barking Road, on Sunday, Oct. 20. The following resolution was passed: That on and after Sunday, Nov. 10, double time be paid for all work done by stokers, firemen, coal trimmers, and pipe cleaners between the hours of 6 a.m. and 10 p.m. on Sundays; and all labourers doing firemen's work receive firemen's pay, and firemen time-and-a-half when not carbonizing. By order of the Executive Council, W. Thorne, General Secretary; W. Byford, General Treasurer." Do you remember that?—Yes; I remember the bill. That was the first resolution passed by the Council. I might state that the Council meeting is an assembly of delegates from each of the stations, who have orders exactly how they are to vote; therefore it really comes from the majority of the members of the Union.

But this was intended to lead to a resolution that you would have double time, was it not?—Yes; a resolution that we were entitled to double time from 6 a.m. to 10 p.m., and that we meant to have it if we could get it.

Then you have spoken of a meeting at Cannon Street. I was not present; but the Engineer was. The meeting at which I was present was in the offices in the Old Kent Road; and you were there?—I was there too.

And we discussed this matter for four hours, I think?—From two hours to two hours and a half were occupied with the profit-sharing agreement, and another hour and a half was spent over the double time question.

I was told then, on the off-chance—I do not say by you—that the reason you demanded the double time was to stop Sunday work?—Quite correct.

I think I asked you what you had to complain of about Sunday work with us; and you admitted, as you have admitted now, that there was practically none?—I quite acknowledge that as correct. At your works, so far as the station I was in was concerned, there was no Sunday labour. I worked only one Sunday.

I think I ascertained from you that this demand originated from works belonging to another Company? It was said that, at certain works belonging to another Company, the men were working nearly every Sunday?—That is correct.

It was to stop that that you made this demand?—Yes. The idea of our Union was then that we, as a body of workers throughout the Metropolis, should stand with the others, and that the other side should do the same with us.

Do you suppose this demand would have been made if the other Company had worked as we do?—I do not think it would, because nobody would have troubled about it if they had not had to work.

It is very fair of you to say that. Then did I not point out to you that, as we did not work on Sunday, I thought it a very unfair demand on your part?—You certainly did. You said that there were two opposite Companies; and you considered that it was a very unfair and unjust thing that you should have the other Company crammed down your throat. I do not say that you made use of so vulgar an expression, but it meant the same.

I said, did I not, that we should not be punished because of the misdoings of the other Company?—Yes.

The CHAIRMAN: Did I understand that the South Metropolitan Company employed Sunday labour scarcely at all, or only once in the year?

Witness: I was twelve months with them; and I only worked one Sunday.

Therefore it was not to punish the South Metropolitan Company?—No; because they never had to do it.

Mr. LIVESEY: At the settlement in July or June, it was arranged that Sunday work should be paid for at the rate of time-and-a-half from 6 a.m. to 6 p.m.; and then, on this resolution of Oct. 20, it was resolved that, on and after a certain day, double time should be paid for all work between 6 a.m. and 10 p.m.?

Witness: Quite right.

The CHAIRMAN: Including four hours more of Sunday work?

Witness: Yes. I might state that the reason they wished to do away with it was that they had once to go in from six to ten o'clock—four hours. We had the satisfaction of going to the factory while the church bells were ringing; and we wanted to see if we could not possibly do away with the four hours. The retorts would not hurt, I think, through being left for that time. If we had not to work then, there would have been no need of the double time. That was the idea of asking for the double time; we wanted to abolish it.

Mr. LIVESEY: The cessation of Sunday work applies only to the daytime on Sunday?

The CHAIRMAN: I understand from six to ten was not recognized as Sunday work, was it?

Witness: No; it was not, at that time. And there was no increase of pay whatever; it was the ordinary pay.

Mr. LIVESEY: Previous to the adoption of the eight-hour shifts, the men would go in at six o'clock, and work the whole night?

Witness: Yes; but they did not go in with a good heart, I can assure you. The hardest thing we ever had, the whole time I had experience of a gas factory, was the going in on Sundays.

As a practical man, you know it is hardly possible to suspend work during 24 hours on Sunday?—I quite understand that; but very often it was done with the other Company—the Company who have caused a great deal of this trouble.

And to stop that, you passed this general resolution?—Yes; to stop that we all formed into a Union; and if we are all one body, it was our duty to have the same system throughout the Metropolis.

When I saw you, did I not say to you: "An agreement was come to on the 1st of July, and you expressed yourself satisfied. Why do not you stand to that agreement—why do you want to alter it now"?—You did not say that.

Did I not say: "What is to be the end of this?"—Yes; you did.

When I stated that we agreed to their time-and-a-half for twelve hours on Sunday, I said; "Now you are reopening the question, and you have made other demands in variation of that agreement, and where is it to end—what is to come next." And then did not Mr. Thorne say to me: "Well, I am in favour of waiting till the half-yearly accounts are out, and seeing what is the position of the Company, before we make any other demand"?—I do not remember Mr. Thorne making use of that language.

Do you remember Madden, the Vauxhall man, saying, "Speak for yourself; we do not say so"?—I remember them saying that they would not pledge themselves that they would not ask for anything at all; but I do not remember that it was Thorne who suggested that it should stand over till February.

Then I said: "I will not risk a strike on such a question as this it will not affect us much. I object to your going from your agreement, or breaking it; but it shall be given, though I will give it under protest"?—Yes.

"I will take it back as soon as I can"?—Well, I did not say you said that, but I had a good mind to do so. It was your intention to take it back at the first opportunity.

Was it not the fact, when this double time for Sunday was given, that in many cases the men wanted to work on Sundays then?—No; I am not aware of that.

At some works did they not try all they could to run the Company short of gas on Saturday, so that they would be obliged to work on Sunday to get the double pay?—More disgrace to them if they did; but I was not aware that they did such a thing.

Then you also spoke about the origin of the strike with the Vauxhall men. At that meeting, when we met at the office, you objected to the clause in the agreement about the men leaving?—Yes.

It is not at a month's notice, but it reads in this way: "No obstacle will be thrown in the way of any man engaged in the above work." The agreement was to be for twelve months. But it was felt, I think—and I explained this—that it would be very hard for a man who had signed an agreement for twelve months, if he had a chance of getting a better berth, to be held to it, and not allowed to take advantage of the opportunity; and so it was altered?—You did make the remark that two or three clauses could be altered.

The CHAIRMAN: Why did you object to that clause?

Witness: We objected to it on the one ground that, if at any time we really wished to leave the factory, it would be a matter of impossibility for us to do so without the Engineer giving his sanction, because that would put us under the Conspiracy Act at once.

Mr. LIVESEY: Then it was altered in this way: "On such notice, the Engineer shall, in his discretion, consider whether the services of such man can be dispensed with without detriment to the Company; and, if so, permission will be given on the expiration of the usual week's notice"?

Witness: Yes; but under that profit-sharing agreement, it all lay with the Engineer, not with the workman. You are bound for twelve months, and there is no escape.

Do you know of any single case in which a man who applied to leave has been refused permission?—No; I do not. I believe candidly that if they had come and asked you, you would have let them go; but I do not say the same of the Engineer or the under-foreman.

It was intended that there was to be no objection whatever to any man, or any reasonable number of men, leaving. But if the whole of the men wished to leave, the Engineer would then say: "I cannot dispense with your services to the detriment of the Company; and therefore I cannot allow you all to leave at once."—Yes; that is really the true meaning of what it was.

The CHAIRMAN: Could he not say that with respect to any good man who wanted to leave the service?

Witness: Certainly.

Mr. LIVESEY: But he never has done so?

Witness: No, he never has, that I know of. Since that time I have left the Company's service; and I could not tell that the thing has never happened.

There were other things talked about?—Yes; there was one thing about giving the foreman entire power to put a man to any work he felt inclined, so that if he should have any petty spite (as they very often have), he could put you to work which was very disagreeable, and really cause a man to break the agreement, and forfeit every penny that would be coming to him under it.

It is the second clause of the agreement, and you contended that this gave the foreman the power of making a stoker who was getting his 5s. 4d. or 5s. 6d. a day into a yard labourer?—Yes. The reason I objected to it really was that I was working for the Company on the other side of the water; and I was sent away from firing to go on the top of the gasholder and sweep off the snow. Therefore as, under the agreement, I was bound to stop for twelve months, I could not consent to it.

Is it not the fact that gas companies employ a greater number of stokers in winter than in summer?—That is quite correct.

What becomes of these men in the summer time?—Some of them go into the brickfields. But in your Company there are a lot who go into the yard; and I believe there are a great many who do so in other companies.

When we could not keep them on as stokers, that clause was to enable them to take work in another capacity?—The word "summer" would have done that, if it had been required; and, as I have stated to the Chairman, you said it wanted altering. You had to agree with us that there were faults; and you said you would rectify them.

Two or three that you mentioned I did agree to, there and then?—Yes. I did not see anything very objectionable in the agreement, except the signing for twelve months. I would have agreed to serve you for two years for half of what you would have given me under the profit-sharing scheme, if I had not to sign for a year. But you said: "No, Mr. Blackburn; you cannot have it that way." There was no compulsion to sign the agreement, only you said that all those who signed would have work in preference to those who did not; and the result would have been that those who did not sign would have to go.

Another point you mentioned was about the breaking of the agreement with us to settle the strike. On the 4th of February, the consumption of gas greatly decreased, and men were being discharged every week at that time; and, of course, you know that the strikers, or the Union, having held out so long, there was very little chance of their getting employment after that date.—Yes.

The Company said all through that they would not discharge one of the new men to make way for any of the old ones; and in the agreement, as you have stated very fairly, it was specified that, if vacancies arose, they should be filled up with the old hands in preference to strangers. Now you say that is broken?—Yes; and the other part of the agreement you entered into is also broken—that you would still stand to the eight-hour shift, if it was not otherwise agreed to. But you are working under the twelve-hour shift now; so that two parts are broken.

It was this, I think: "We will work on eight-hour shifts unless otherwise mutually agreed?"—"Mutually agreed;" that was it.

Was it not mutually agreed that they should go on the two shifts at the Bankside works?—I could not say; you were really dealing with non-union men when the strike was brought to a close. We had left you. If the men who were working in the factory—the non-unionists—agreed to return to the twelve-hour shift that did not make it the carrying out of the agreement you had entered into. We cannot be answerable for them if they were outside the Union.

They went to work on the twelve-hour shifts on their own option?—Yes.

Did Mr. Thorne make a speech at Plymouth on Saturday, the 15th of February?—Yes.

I think you said that after we agreed to take back the old hands as

vacancies arose, in preference to strangers, we shortly after that refused to employ members of the Union?—Quite right.

In that speech there is a good deal about the gas strike; and towards the end of it Mr. Thorne is reported to have said: "The time would come when men would not be compelled to sign an agreement; and he warned the consumers of London that the men would not give seven days' notice again before striking. It was evident that partial strikes would not succeed; and he advised all labourers to federate, so that, in the event of another strike, they should all go out together." You have heard of that speech, I suppose?—I heard that he made a remark there to that effect; but I never read the speech. It is really his own utterance. There was never any meeting called; and the men did not give him authority to use that language.

Do you know that the men, while they were out, repeatedly said that the mistake they made was in giving a week's notice, and that they ought to have come out without notice?—I have heard that remark made. It has been remarked by some of them that they should have left without the week's notice.

In consequence of that, did the Company put up a notice that they would not employ unionists?—Yes, and I know they have been refused; and I know further, though I was not working for you, that your foreman told men that, if they came to live in my house, they would lose their situations. I said to the Engineer: "I have come to you to speak about this; and if I cannot get satisfaction, I will go to the Chairman, because I do not think he would be guilty of preventing me getting a living because I have left his employ."

The CHAIRMAN: Did Mr. Tysoe admit the truthfulness of your statement?

Witness: Yes; he said he had heard of it; and he told the foreman that the men could live where they pleased, and that it had nothing whatever to do with the Company. This man remained at my house, and stopped there about six months.

Mr. LIVESEY: Now we come back to what Thorne said. A notice was put up quoting it; and then it stated this: "To protect the consumers of London, notice is hereby given that no members of the Gas Workers' Union will be employed." That is what you complained of?

Witness: Yes.

Going back to the question of Sunday labour—I have thought of it since—you asked for double time from 6 a.m. to 10 p.m.? Did I make any offer?—You made an offer that you would do away with all Sunday work if you possibly could; and, further, that if we objected to working from 6 a.m. to 10 p.m., we should do the work on Sunday morning instead of Sunday evening, because you considered that it was quite right, and that the men really should be at home if they could on a Sunday evening. I do not think you agreed to time-and-a-half up to 10 o'clock; but I will not be positive.

Did I not say: "I will not agree voluntarily to the double time from 6 a.m. to 6 p.m.; but if you like to accept this as a compromise, I will extend the time-and-a-half to 10 p.m., and make the time-and-a-half from 6 a.m. to 10 p.m."? Then you remember, when you came for a character, you said that there was a great mass meeting in Deptford Broadway to determine whether they would accept this offer, as a proposal was going to be made to accept it?—Yes; an amendment was going to be put to accept it; but this was not done. The resolution was not put that Sunday. Instead of agreeing to the double time, the meeting took the course of not signing the bonus agreement.

Mr. *W. H. Ward,* Assistant-Secretary of the Gas Workers and General Labourers' Union, was then called and examined by the CHAIRMAN. He said the Union extended throughout the United Kingdom, and embraced at least 70 different descriptions of labour. On the formation of the Union, it was intended for gas workers only; but several applications had been made to join them, seeing that they had gained what might be termed a "bloodless victory" in obtaining the eight-hour working day; and then they had to extend the name, and have the rules altered. They then called it "The National Union of Gas Workers and General Labourers." At the commencement, there were about 45,000 gas workers in the Union; but they had to thank Mr. Livesey for decimating their numbers. They had now between 45,000 and 50,000 members of all kinds. Only a little more than half were gas workers; the number having diminished to a great extent, owing to failures in strikes. They had now from 25,000 to 30,000 gas workmen; so that the number had dropped about 15,000. In Belfast, where the Corporation were owners of the gas-works, every workman in the carbonizing department was a member of the Union; and they obtained for them very great concessions—as much as 7s. a week advance in wages, besides getting them an eight-hour working day. Then, he supposed, they considered the Union had done as much for them as they expected; and they became dilatory, and fell away from it to a great extent. They had, however, still some members there. The majority of the gas workers throughout the kingdom were now working eight hours a day; and their wages were, on the whole, better than they were three years ago. Having diminished the hours of labour, the men, as a rule, managed to do the same amount of work in a less time than they did formerly. He might explain that there was an erroneous idea in the minds of the public that the gas workers, by getting an eight-hour day, only did two-thirds of the work; but they were doing more in the eight hours, comparatively speaking, than they formerly accomplished in twelve—he meant, more per hour. Taking the Beckton station of The Gaslight and Coke Company—the largest gas-making station in the world—the men formerly did 84 retorts in twelve hours, whereas now they did 72. In the South Metropolitan Company's works, they did 96 retorts in the twelve-hour, and 80 in the eight-hour shift—a reduction of 16 in the latter Company's works. The hours were reduced by one-third, and the production of gas by one-sixth in that Company. In the Commercial Company's works, the men did now, on the eight-hour system, 66 retorts per man per day; whereas formerly they did 72. In some companies they had not altogether the same method of working. It might be a far easier job to do 80 retorts in one company's works than 70 in another.

The CHAIRMAN: What I want to get at is the comparison between the amount of work done in eight hours now with what was done in twelve hours before. How much less is it?

Witness: It would be something like 22½ per cent. all round. It is 33 per cent. in one department, because there was one man before where there are two men now. There are three men doing what two men formerly did in the firing department. The cost of production is necessarily increased wherever the eight-hour system is adopted.

Examination continued: We are content with our present arrangements as to labour. The Union, as a whole, are in favour of the legal enactment of the eight-hour day. One of the honourable members of this Commission has deprived the men, so far as his works are concerned, of the eight hours, and put them back on the twelve. We have no security. What we want is to have it placed upon the Statute Book of the country, so that it will be impossible for Mr. Livesey, or any other man who may be so disposed, to deprive us of it. I wish to say something about the sanitary arrangements in the workshops. The men in most of the works have no place in which to wash themselves after their day's work. A gas stoker, when he goes into the works, divests himself of all his clothing, and puts on any old rags—chiefly flannel—to do his work in. Then the fine coal dust penetrates through this flannel; and he is perspiring all day long. I therefore think that, after a man has finished his work, there ought to be means for properly cleansing himself. I should like to have in all gas-works proper rooms, where the men could be supplied with chairs and tables on which to take their food, and also cooking utensils. In some cases this is done on a very elaborate scale; but in other cases it is not. Then as to the introduction of machinery in gas-works. In the Manchester Gas-Works, where I worked for 17 years, we had an eight-hour shift, and we enjoyed all the blessings of an eight-hour day for upwards of twelve years till machinery was introduced, and then we went back to twelve hours. I am acquainted with the strike at the South Metropolitan Gas-Works. I deprecated intimidation on all sides in connection with that strike; but I have been intimidated in taking the men strike pay.

The CHAIRMAN: Are you sure that none of the men who came up from Manchester, for instance, and who took service under the South Metropolitan Gas Company, received insults or attacks upon them?

Witness: I believe there was an attack. However, I was on a bed of sickness at the time. I was informed that an altercation took place in Blackwall Lane between some of the Manchester men and some of the strikers.

But you are aware that there were some men who came up from Manchester, and took service under the South Metropolitan Gas Company?—Yes; because I took them out of the Old Kent Road works, and paid their railway fares back. I took 23 out of the East Greenwich works, and their fare also was paid back.

Is it the case that for some weeks it was dangerous for anyone employed on the works to go outside, and that many who did so were badly injured; that for many weeks the men employed were fed and lodged on the premises, and, in addition, that the works were guarded night and day by policemen?—Yes; I believe the works were so guarded. As to the rest of your question, I should be the first to admit it if so; but, as I said before, I was very ill at the time, and for anything that occurred I had it only on hearsay.

Then personally you are not aware that men were molested and injured during that strike?—I am not. I have read of men being convicted and sent to terms of imprisonment for something or other. This I am aware of, that certain men, in East Greenwich especially, were supplied with revolvers, and they made very good use of them, because, passing down Blackwall Lane myself one day, Jackson, a foreman whom I had formerly worked under, said when he met me: "Bill, this is the way we do it;" and he discharged two barrels of the revolver. Whether or not he meant to intimidate me, I do not know. I was ill at the time; or I assure you his revolver would not have frightened me.

Mr. *Blackburn* was here recalled, on the suggestion of Mr. Trow.

The CHAIRMAN: As far as you are aware, was there intimidation and violence during the strike at the South Metropolitan Gas-Works?

Witness: Yes, there was.

And the men who were inside, who were from a distance, could not safely come outside the works, could they?—It was not very safe for them outside. Some of them, I believe, were rather roughly handled. I was not actually there myself to see it; but I have heard of a good many cases. There was one public-house just outside the works, where non-Union and Union men both went, and the meetings generally ended up with rather serious quarrels. It is quite correct to say the police were stationed at the works till the strike ended.

Did the Union, directly or indirectly, countenance this intimidation and outrage upon the non-Unionists who were inside the works?—Oh, no; the Union in no way whatever helped the men, or wanted them to commit that kind of thing. It was really done by the men themselves out of spite, because the others had come in—that is the way to put it. The Strike Committee meeting was held at my house; so I can answer for the fact that the Committee for the district advised the men, on four or five different occasions, to go along quietly, and then we should get public sympathy, and win the battle far better than we could with sticks and stones.

You say deliberately that the Union did what it could to discountenance violence?—It did. I have heard the officials of the Union there tell the men to go quietly to work, and not to create any disturbance at all.

Mr. LIVESEY: I will ask one question of you about that. The Union did put on a great many pickets, I suppose?

Witness: Yes; but pickets were merely to advise the men not to go in—to ask them if they would stand to the cause of Unionism, and win the battle. If any of the pickets took it into their own hands to strike anybody, or to cause any disturbance, they did it on their own responsibility, and were not so advised by the Union.

How many pickets did you put on?—We had six at the big gate, and four at the other gate, down by Taylor's, the Audience Rooms, and three at the other gate. I am speaking of the immediate neighbourhood where I was. I do not answer for any other place.

You have said the disputes arose over drink?—Yes; a great many of them did.

But a good many quarrels took place in the road, away from the public-houses?—Yes; but that was all their own matter. They were not advised by the Union in any way whatever to do it.

Mr. *Ward,* in further examination, stated that in regard to violence

the General Secretary, himself, and the President of the Union, denounced it in every way. There was never a branch room that they visited on this side of the water where they did not always advise the men to avoid violence of every description. They told them to treat the men with disgust, not to associate with them—not even to speak to them; but certainly not to lay hands on them. This was their advice continually during the strike; and he must say that many times the men asked permission to have a fair "go in," and settle it one way or the other. They did not allow them; and he was almost sorry they did not.

The CHAIRMAN: Do you say you are sorry you did not?

Witness: Conscientiously, I am. When I saw men who had worked for years for the South Metropolitan Gas Company, and had comfortable homes, compelled after the strike to sell everything, I could not help it. I can hardly describe it. It was very hard to see men coming from all parts of the country to deprive honest working men—men who had been in some cases 20 years in the service of the Company—of their livelihood. It was very hard to see as many as five and six men brought in to do one man's work, in order to defeat them. There is one statement made by Mr. Blackburn, in answer to Mr. Livesey, during his examination, which I should like to correct. He said there was no Sunday work carried on at the East Greenwich station. I say there was, because Mr. Blackburn and I worked there together; and I never knew a Sunday while I was in the employ of Mr. Livesey that a gang of men did not have to go in from six o'clock in the evening till ten at night, winter and summer.

But Sunday work was understood to be work done between six and six on Sunday, was it not?—In the twelve hours.

But that was what was generally understood as Sunday work. Was not that so?

Mr. *Blackburn:* That is, I believe, the understanding.

Mr. LIVESEY: You said something as to there being no place to wash in. You do not mean that to apply generally?

Witness: I most decidedly admit that, in your works at East Greenwich, there is nothing to be desired further in that respect. I will give you credit for that.

In the large gas-works of London, they generally have accommodation?—Yes; but it is not what it should be. I might say that in the London gas-works they are years in front of the provincial ones in the matter of sanitary arrangements, and the provision of cooking apparatus for the men. They look to the interests of their workmen far better than is done in the provincial works.

Was it not your object, when you started the Union, to get the men, yardmen and all, into it?—Undoubtedly. We would not refuse any of them.

You would have used gentle persuasion?—Yes; and I think you, Mr. Livesey, do not know of any instance where we ever used force of any description to make men become members of our Union.

Such cases were reported; but there was not sufficient proof. At any rate, you got all the stokers in?—Yes.

Mr. LIVESEY then questioned witness on the subject of the eight-hour day, and the introduction of machinery. He said, in reply, that he knew there had been an eight-hour shift for 40 years at the Toxteth Park works of the Liverpool Gas Company, where he had worked a long time ago, and also at Bristol. So that it was not a new thing in gas-works when the Union asked for it. One of the reasons for applying for it was the displacement of men by machinery. A good deal of machinery had been introduced for gas-making purposes before the Union was thought of. West's machinery had been adopted at Birmingham and also at Richmond; and he believed Mr. Livesey and his co-Directors had put it into the Old Kent Road works, and would extend it if it suited them. He did not think a great impetus had been given to the use of machinery since the formation of the Union.

Mr. LIVESEY: You do not think so?

Witness: No; I do not. I might as well be frank with you, Mr. Livesey. You used a great many adjectives in referring to our Union; and I heard you do so to-day, when you called it a very "aggressive" Union. But the very fact of its being aggressive might be an inducement, or at least an excuse, for engineers and managers of gas-works to say: "Well, we had better introduce machinery, on whatever pretext it may be." Your Company have expended thousands upon machinery which is now only fit for the scrap heap. Who is paying for that? Not the Directors; the gas consumers have to pay for it, indirectly. Take the case of The Gaslight and Coke Company. I do not know that there is a company in the world which experiments more than they do. The result is, up goes the price of gas. The price has gone up since the adoption of the eight-hour shift. As to the Commercial Company, they know very well that they will never get any sort of machinery to supersede manual labour; and, in fact, as far as the production of gas is concerned, they are content with labour. They will adopt all new kinds of retorts; but machinery they fight shy of. The result is that they have no need to increase their price. They have done so a little in the last quarter.

The CHAIRMAN: The price of the Commercial Company's gas is 2s. 6d. per 1000 cubic feet, and that of the gas supplied by The Gaslight and Coke Company is 3s. 1d. Do you say that the 7d. difference in the prices of these two Companies is due to outlay on machinery on the part of The Gaslight and Coke Company?

Witness: To a great and foolish outlay in the way of experiments. It is the only cause I can assign for it. There are men working for the Commercial Gas Company the same number of hours, carbonizing the same weight of coal, getting the same amount of wages, doing the same quantity of work, and using the same materials; but in their balance-sheet, you will not find a line of four or five figures for machinery. They believe in manual labour for making gas; and very wise on their part it is, too. They do not believe in bringing in drawing-machines or charging-machines; and they are as well off as if they did. The Company expect bone and sinew in the men, to keep them in perpetual motion; but if the men stop away, it is attributed to drunkenness, even if they are members of temperance societeis. Mr. Chairman, if you knew the way in which gas workers are, as a rule, treated, you would hardly credit it. I do not say that the shareholders, or Directors, or even the managers, are responsible for this; but their foremen are, to a great extent.

Mr. LIVESEY: Have you any idea of the amount The Gaslight and Coke Company have spent upon machinery? Is it £50,000?

Witness: I do not know the exact figure.

That does not account for the increase in price, does it? Do you not think that the advent of the Union has led gas companies to go more into machinery than they did before?—Yes; I believe it has.

You said something about the foremen at East Greenwich being supplied with revolvers. Who supplied them?—The Company—at least, so we were given to understand; and I shall always believe it till you prove the contrary.

You may take it from me that we did not do that.—I will take your denial. I simply give you the information that was conveyed to me; and, of course, it looked very suspicious.

Mr. LIVESEY next proceeded to question the witness as to a meeting on Peckham Rye last summer. In reply, he said he remembered the meeting, and also that Mr. Tysoe (the Superintendent of the East Greenwich station) was present. He had no recollection of saying to him: "We shall have all your men in the Union before Christmas, and then we shall have another turn out." He happened to make some allusion to the East Greenwich works; but no one, with the exception of a few of the East Greenwich men, out of the 4000 or 5000 persons, knew Mr. Tysoe. As soon, however, as he lifted his hat to emphasize the reference to East Greenwich, they said: "Oh, this is Mr. Tysoe that Mr. Ward is referring to;" and then there was a sort of wave, and they pushed him back. He (witness) begged them not to injure him, because if they did so it would be injurious to them; and he denounced violence upon that platform. Mr. Tysoe stood upon the step of the van, and said: "You know, Ward, they are only injuring their own cause by the step they are taking to-day." He (witness) said: "Do not be frightened; they will not injure a hair of your head. Depend upon it, Thorne and I will not see you injured," and he added, jocularly: "It is no good, you will have to turn all over to us again." But as to saying they would have to strike then or at any other time, that was not so. He merely used the words jocularly, and never threatened a strike of any description; and it hurt his feelings when he heard about it.

By Mr. AUSTIN: We do not object to work with non-Union men. We use all moral persuasion to get them into the Union if possible; if not, we work amicably with them. The men who took the places of the strikers came from all parts of the country—a good many of them from Manchester and Salford. They were very liberally dealt with. I have a complaint to make as to the way in which the officials of the Union and the pickets were treated by the police authorities. Whenever we were holding demonstrations previous to the strike, we were never interfered with on the south side of the water; but after the strike occurred, we sometimes met with very rough handling. We knew very well that it was only an invitation to resent it; but we thought discretion was the better part of valour. We only wanted to maintain the name we had of being the quietest body of processionists that ever went through the streets of London. I mean by "rough handling" that the policemen shoved us about to see if we would retort. The strike cost our Union £12,000. Since it was formed, we have spent £27,000 in strikes; but the wages of the men have been increased by more than £1,000,000. As I have said, the members of the Union work amicably with non-Unionists; but, as a society, we have struck because there were a number of non-Unionists on the works. In the Manchester case, however, the thing was done by our District Secretary—a man named Horrocks. We knew nothing about it till it was too late; and our General Secretary (Mr. Thorne) proceeded to Manchester at once, and sought an interview with the Mayor, and also with the Mayor of Salford. The Salford men had no grievance at all. They were all members of the Union; and they simply came out in sympathy with the Manchester men, for fear the Salford Corporation would supply Manchester with gas. We did not at all approve of it. The General Secretary went down and condemned the action of Horrocks in calling the men out. They were young to Trade Unionism; and, unfortunately, they were too impetuous, and wanted it all their own way. In fairness to the Manchester and Salford Corporations, I might say that they conceded everything the Union asked for except a few petty matters, such as putting down weighing-machines. The affair was on the point of settlement, when Horrocks made use of some violent language. When the General Secretary went to Manchester, he ordered the men to return to work. But the Gas Committee would not take them back; and they had to stand at the gate and take their chance of being engaged as well as anybody else. We asked the men to do this as a protest against the action of the Secretary. The real cause of the strike, so far as we could ascertain, was the fact of there being six men in the Manchester works who, from conscientious scruples, would not join the Union. Unfortunately for us, no matter what the men may do by impetuosity, or anything like that, the blame is thrown upon the Executive Council.

Mr. LIVESEY: You gave the Manchester men very little pay?

Witness: They were not entitled to it. We did that also as a protest. They had not been five weeks members of the Union; and, according to the rules, they must be in it six months before they can come out on strike pay.

Mr. TAIT: You did not give them any strike pay?

Witness: We simply gave them a sum of £200 after the General Secretary came back. We pointed out plainly to them that they should abide by our rules.

Witness was then questioned on the subject of intimidation. He remarked that if it was not intimidation or coercion for an employer to call his men together and tell them that they must either leave his service or leave the Union, he did not know what was. If this did not come within the law, he would amend the law so as to cover such a case. With regard to the general question of the supply of gas and water, he thought the Legislature should give County Councils and Corporations full authority over it, because in Leeds 18-candle gas was sold for 1s. 11d. per 1000 cubic feet; being 2 candles higher quality than was given in London, where the charge was 2s. 6d. and 3s. 1d.

On being reminded by Mr. Livesey that the Newcastle Gas Company supplied gas as cheaply as the Leeds Corporation, witness replied that they were right in the coal-fields. Gas companies were not, he said, content with less than 13½ per cent. dividend.

Mr. TROW remarked that at Darlington the gas-works belonged to the Corporation; and, though these were in the midst of the coal-fields, the price was 2s. 6d. per 1000 cubic feet. On the question of the effect of reduced hours on foreign competition, witness said they could not send gas in balloons from Germany.

The CHAIRMAN asked witness what course he would adopt to prevent strikes.

Witness replied that he would advocate a Court of Conciliation and Arbitration of the parties interested. He wished the London Gas Companies would appoint their managers to represent them; the Gas Workers' Union would then nominate an equal number of representatives, and so settle all disputes. If this course were offered, they would gladly try it.

Mr. AUSTIN asked, in the event of the adoption of an eight-hour day not having the effect of finding employment for all, whether witness would recommend a further reduction.

Witness said he certainly would, where, as in gas and chemical works, the employment was extremely laborious.

The Commission then adjourned till next day.

GAS PROVISIONAL ORDERS FOR THE PRESENT SESSION.

The Board of Trade have issued a Memorandum stating the nature of the proposals contained in the Provisional Orders included in the Gas Orders Confirmation Bill, the introduction of which was noticed in our "Parliamentary Intelligence" on the 3rd inst. There are five Orders in all. The first is to empower the Cullingworth Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the township and parish of Bingley and the township of Wilsden, in the parish of Bradford, all in the West Riding of York; also to fix the capital at £18,000 by shares and £4500 by loan, and the price to be charged for gas at 3s. 6d. per 1000 cubic feet, with sliding scale as to price and dividend. The second is to authorize the Kempston Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the several parishes of Kempston, Elstow, and Wootton, all in the county of Bedford; also to fix the capital at £5000 by shares and £1250 by loan, and the price to be charged for gas at 5s. per 1000 cubic feet, with sliding scale as to price and dividend. The third is merely to enable the Mitcham and Wimbledon District Gas Company to construct and maintain additional works. The fourth is to empower the South Normanton, Blackwell, and Hucknall-under-Huthwaite Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas within the parish of Blackwell and parts of the parishes of South Normanton and Tibshelf, all in the county of Derby, and to supply gas in bulk by agreement beyond the limits of supply. The capital is to be fixed at £12,000 by shares and £3000 by loan, and the price to be charged for gas at 5s. per 1000 cubic feet, with sliding scale as to price and dividend. The last Order in the Bill is to authorize the Sutton and Hooton Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the townships of Willaston, Hooton, Childer, Thornton, Great Sutton, Little Sutton, Ledsham, and Capenhurst, all in the county of Chester; to fix the capital at £8000 by shares and £2000 by loan, and the price to be charged for gas at 5s. 3d. per 1000 cubic feet, with sliding scale as to price and dividend.

EXHIBITIONS OF GAS APPLIANCES.

An exhibition of the well-known gas stoves and appliances of Messrs. Fletcher, Russell, and Co., of London and Warrington, was held in the Lesser Colston Hall, at Bristol, during the past week. Cookery lectures were given each evening by Mrs. Wilkinson, late of the National School of Cookery, South Kensington. Under the auspices of the Darlington Corporation Gas Committee, an exhibition of stoves manufactured by the Davis Gas-Stove Company, of London, was held during four days of last week. The exhibition was opened on Tuesday, by Mr. T. M. Barron, the Chairman of the Gas Committee; and Mrs. C. F. Pitcher gave practical demonstrations on cooking by gas each day. The Harworth Gas Company held an exhibition of gas appliances during the first part of last week. Messrs. J. Wright and Co., of Birmingham, showed a number of cooking and heating stoves, and Messrs. W. Russell and Son, of Darlington, had a good display of gas fittings and other appliances. Miss Shaw, of the Nottingham School of Cookery, delivered interesting lectures daily. It should be mentioned that, with a view to extending the consumption of gas, the Directors of the Company have reduced the price of gas used for cooking and heating purposes to 3s. 6d. per 1000 cubic feet. An interesting exhibition of gas appliances, held by Mr. Steed Bayly, in conjunction with Messrs. Richmond and Co., Limited, of Warrington and London, was opened by the Mayor of Deal, in St. George's Hall in that town, last Tuesday. Lectures on cookery were given twice daily by Mrs. Bennett, of the South Kensington School of Cookery, to large and appreciative audiences. Short and concise addresses were delivered by Mr. Steed Bayly and Mr. A. Mead; the latter gentleman being Messrs. Richmond's representative. The exhibition closed on Friday. During the past week, the Lea Bridge District Gas Company held an exhibition of gas cooking, heating, and lighting appliances at the Victoria Hall, Walthamstow. Lectures on cookery were given twice each day by Miss Garstin. Messrs. Fletcher, Russell, and Co., of Warrington and London, had a large display of their well-known gas cooking-ranges, fires, &c. The lighting exhibits and gas apparatus were of a varied character; the whole forming a very interesting collection. All the arrangements were admirably carried out by Mr. W. Thorman, the Company's Manager.

New Joint-Stock Company.—The Ironbridge Gaslight Company, Limited, has been registered with a capital of £8550, in £7 shares, to supply Ironbridge, in Shropshire, with gas.

MANCHESTER CORPORATION GAS SUPPLY.

The Proposed Reduction in the Price of Gas.

At the Meeting of the Manchester City Council last Wednesday—the MAYOR (Mr. Alderman Leech) presiding—there was a debate on the proposal to reduce the price of gas.

Mr. BROOKS moved that the price of gas be reduced within the city, from 2s. 6d. to 2s. 3d. per 1000 cubic feet; beyond the city, from 3s. to 2s. 9d.; and beyond the River Mersey, from 3s. 6d. to 3s. 3d. He said he thought the rate paid by the consumers had for many years been excessive. The recommendation made for a reduction of 3d. all round was not, in his opinion, other than very moderate.

Mr. MAINWARING seconded the motion.

Alderman KING said the proposed reduction in the price of gas was inopportune, especially as they had an increased School Board precept and knowing the important works the Council had in hand. He considered the price was not too high, and that a reduction would be neither justifiable nor equitable. The reduction in the price of gas would result in a less amount by £36,000 payable to the citizens by the Gas Committee, entailing a further charge of 3d. in the pound on the ratepayers. This made a total increase in the estimates of £107,000, or 9d. in the pound on the rates of the city. He read a long speech, giving reasons for his objection to the resolution, and moved, as an amendment, that the proposed reduction be not agreed to.

Mr. RUSHWORTH seconded the amendment.

Alderman Sir J. J. HARWOOD asked those who were in favour of the proposed reduction to pause before they voted. This year the Gas Committee would have to pay £10,000 more for coal and cannel; and it was estimated that the Committee would get £12,000 less for tar. Then it must be remembered that they were putting down an installation for electric lighting at a cost of £100,000; and this would be unproductive for a considerable time. Then they were constructing additional gas plant, which would only be called into requisition, and only be productive, a short time in the winter or in foggy weather. Having regard to these matters, would it not, he asked, be wise to wait for twelve months, in order that they might obtain full information upon the matter.

Alderman GRIFFIN, as a member of the Gas Committee, appealed to the Chairman to withdraw the motion.

Alderman HIGGINBOTTOM said the policy of the Committee was the proper one to support; and it was the carrying out of the direction given to them by resolution of the Council on May 6, 1890. As to putting the matter off for twelve months, he thought that Sir John Harwood had shown that they would then be in a worse position than at present; and if they did not make a reduction in the price now, they would probably never get it.

Mr. MURRAY held that the gas consumers were entitled to the benefit of the proposed reduction.

Mr. MAINWARING said there was no time so opportune as the present for the proposed reduction; and there had never been more unanimity in the Committee on any question than on this, for 14 had voted for and only 4 against it. It would bring direct taxation on the ratepayers, which was a desirable thing; and then the ratepayers would put a check on the extravagant spending departments of the Corporation.

Mr. WILSON believed that more gas would be consumed after the reduction. Some of the 44 per cent. of the population who did not use it would do so; and the profits of the Committee would be thus increased by the reduction.

Mr. CLAY remarked that the gas consumers of Manchester had paid more than £2,000,000 for the gas-works. They were ratepayers as well as consumers; and with the proposed reduction, they would still have a reasonable profit.

Alderman THOMPSON said that if the Council were not careful what they did, they would drive people who were heavy ratepayers out of the city. He implored them to pause and consider these matters carefully. Since he had been in the Council, they had reduced the price 50 per cent.; and yet members still contended that they were doing nothing for the consumers.

Other members spoke in a similar strain; and, in the end, the amendment was passed by 41 votes to 29.

ROCHDALE CORPORATION GAS SUPPLY.

A Diminution in the Profits—Water Gas—An Advance in Price Recommended.

At the Annual Meeting of the Rochdale Town Council last Thursday week—the DEPUTY-MAYOR (Mr. W. T. Heap) in the chair—the above subjects were introduced to the notice of the members.

Alderman PETRIE, in moving the adoption of the minutes of the Gas Committee, said that, seeing their operations were very largely responsible for the increased rate that was being so much talked about, it was desirable that he should say a few words, in order that the Council might judge whether the Committee were blameable for the diminution in the profits. The result of the working of the Gas Department was determined mainly by four things—(1) the cost of coal; (2) the cost of labour for manipulating it; (3) the value of residuals; and (4) the price of gas. Of these four items, only the last was under the control of the Committee; the other three were regulated by the state of the market. In the year ended March 25, 1891, the cost of coal, including carting and stacking at the works, was 12s. 3 2-10d. per ton; for the past year it was 13s. 5¼d. It might be remembered that the last contract for coal was 6d. per ton less than in the previous year. How was it, then, that the money paid for fuel was more? It was only in theory that the contract price was less. Nuts were purchased to mix with the ordinary coal. When the previous contract was made, they still had 7000 tons of nuts bought at 2s. 9d. per ton less than they were now paying. That coal was worked up during 1890-1891, and made the price of the mixed coal really less than the price of the new contract. This accounted for some part of the increase in the price of coal. The remainder was caused by the Committee having to buy 5000 tons of cannel. It might be said that for some years they had made gas without the use of any cannel. That was so; but they knew that in the depth of winter they

had been put to great straits to keep anywhere near to the standard of illuminating power, owing to the increased consumption and the greater expectations of the public. The improvement in the quality of the gas accounted for an advance for the year of 1s 2½d. per ton on a consumption of 40,300 tons. Then there had been a very sad falling off in the amount received for residuals. For coke, while they sold 2800 tons more than in the previous year, they received £148 less. Taking the residuals altogether, they yielded in 1890-91, 7s. 5 3-10d. per ton, and in the year just ended only 6s. 9½d.—a difference of 7¾d. on the 40,000 tons. Deducting the price of the residuals from the payment for fuel, they found that the net cost was 4s. 9 9-10d. per ton in the previous year, and 6s. 8d. in the past year—a difference of 1s. 10d. With one more item the comparison would be complete. The cost of labour was 2s. 10 8-10d. the previous year, and for last year 3s. 0¾d.,—a difference of 1¾d. The total net cost of carbonization was 7s. 8¾d. in 1890-91; and in the past year, 9s. 8 6-10d., which was practically an increase of 2s. per ton. In 1890-91 the cost of carbonization was £15,389; and in 1891-2, £19,601, or an increase of £4212. This about accounted for the difference in profits. They could have made the profits larger by increasing the price of gas. Some members, he believed, would suggest the advisability of doing so; but he hoped the Council would not for a moment entertain the idea. What would be the effect if they did? It would mean that, because one man used more gas in a year, he would be bearing more than his share of the taxation, which in his (Alderman Petrie's) opinion ought to rest on a basis different from that. If in past years they had not had such great profits, and had let the rates stand on their own bottom, they would not have been so badly off as they were now. So long as they took the gas profits, or any other profits, to relieve the rates, they did not feel the weight of it; whereas, if the rates rested on a proper basis they would begin to do something when there was an increase. He hoped the Council would deem this statement satisfactory.

Alderman TAYLOR asked what was the result of the Committee's investigation into the question of manufacturing water gas.

The TOWN-CLERK read the official report, which, after describing the system, said it had not been tried sufficiently as yet, and that there were not enough data as to the cost, &c., to justify the Committee in making any recommendation in regard to it.

Alderman PETRIE, in reply to questions, said the public lamps cost about £4600 a year. The Committee had not considered an increase in the price of gas; but an advance of 1d. per 1000 cubic feet would realize, he believed, about £1500.

Mr. SHARP said the amount spent on public lighting brought the profit up to £9000 or £10,000, and he thought that was very good indeed. He was one of those, however, who considered that taxation and representation should go together, and that every elector in the town should be made to feel it when the rates went up. He suggested an advance in the price of gas, in order that the increase of rates might not fall upon one class of the community alone—that class which was directly taxed by the Corporation.

Alderman BARON said unhesitatingly that there were thousands of consumers in Rochdale who obtained gas for less than it cost the Corporation, taking the cost of meter inspection, collecting, &c., into consideration; and he was prepared to support an advance in price. This he considered the most equitable way of dealing with the matter, taking the whole population into consideration.

Mr. LEACH thought Alderman Baron was entirely overlooking one important matter. To say that they did not charge enough for their gas, when they had a yearly profit of from £9000 to £10,000, was preposterous.

The DEPUTY-MAYOR said that £10,000 was only 7½ per cent.; and, as a matter of fact, they did not derive £10,000, but only £4000 which was but 3½ per cent. Beyond that, he thought they ought to depreciate to the extent of several thousands a year more than they now did. It was true that the public lamps were lighted; but that was for the benefit of those who did not pay rates. There were a great many people who paid no rates whatever except through their gas bills.

Alderman PETRIE remarked that, if they reckoned their profits in the same way that limited cotton companies did, they would amount to more than double the 7½ per cent.; and if they raised the price of gas in order to make the small consumers pay a fair share of the expenses, what an enormous profit they would be making out of the large consumers! The way to deal with the matter was not to increase the price, but to alter the scale of discounts.

The minutes were then confirmed.

BOLTON CORPORATION GAS SUPPLY.

The Annual Statement.

At the Monthly Meeting of the Bolton Town Council last Wednesday week, the annual report on the working of the Gas Department was presented, as briefly noticed in the JOURNAL last week.

Alderman MILES, the Chairman of the Committee, in moving the adoption of the report, said that, for some years back, they had been enabled to considerably reduce the capital account by doing certain work out of revenue. The Committee kept this object steadily in view, and were determined not to relax their efforts until the capital account was brought down to a perfectly satisfactory figure. During the past financial year, their revenue had not been quite so good as he could have wished; and this arose mainly, if not wholly, from causes over which they had no control. The increase in the sale of gas had been very gratifying; being 34,625,000 cubic feet, or about 5½ per cent. on the year—representing an increase in income of £4600. Coke, owing to the seriously falling market, had produced £4717 less than in the previous year; and sulphate, for the same cause, £541 less—the present price of this article being the lowest on record. The gas-fitting department had not done quite so well as formerly; the net profit being £930, as against £1186 last year. The average price per ton of coal had been exactly 6d. more than the preceding year; representing an extra expenditure to them of £2000. Wages for carbonizing had advanced; but the other items were pretty regular in their amounts. There was one he wished to refer to in this connection. It was that of £245 for bad debts, as against £90 last year. This was accounted for by the abolition of the deposit system; and it had become necessary to reimpose the deposits on one particular class of consumers, which had made the greater portion of the loss. The gross profit on the past year's working was £47,127, as compared with £53,756; and after providing for the requisite standing charges, there was a balance of £16,352, which the Committee recommended should be transferred to the relief of the district rates. This amount was equal to about 3 per cent. on the capital. With regard to the prepayment system, the Committee had now 134 meters fixed. He believed that this system was a great boon to the poorer class of ratepayers; and it was likely to extend when properly known and understood. They had 100 gas-engines in use in the borough and district; and about 1350 hired gas stoves and cookers of various kinds, in addition to about 1000 stoves owned by consumers. The annual consumption of gas from these sources was more than 25 million cubic feet, and was increasing at the rate of 20 per cent. yearly. In conclusion, he said the Sub-Committee having charge of the electric lighting question had been vigorously prosecuting their inquiries, and would shortly present a report for the approval of the Council. Their works were in excellent condition generally; and he had pleasure in complimenting the staff on the manner in which they had performed their duties.

Mr. ENTWISTLE considered that a reduction in the price of gas by 3d. per 1000 cubic feet would lead to a greater consumption, and ultimately be to the advantage of the Corporation.

An amendment was moved to the proceedings of the Committee, to the effect that £10,000 of the profits of the Gas Department should go to the reduction of the rates; and the balance of £6351 in reduction of the capital account. The argument of those supporting the amendment was that the ratepayers whose rates were included in their rent derived no advantage from the profits made upon the gas.

Alderman MILES, in reply, pointed out that, with a reduction in the price of gas, the relief at present forthcoming in rating would be greatly diminished; and they should not forget that the ratepayers in the borough ought to reap the full advantage derived from the undertaking, which would not be so if they followed out the suggestions of the supporters of the amendment. There was no reason why they should make a present of £1580 to the outside consumers, who had not the slightest responsibility. As to the reduction of capital account, they were doing that by leaps and bounds. In 1878, it stood at £1154 5s. 3d. per million feet of gas made; while in 1892, it had been reduced to £680 9s.

The proceedings of the Committee were confirmed by 31 votes against 13.

WIGAN CORPORATION GAS AND WATER UNDERTAKINGS.

The Results of the Past Year's Working.

At the last Monthly Meeting of the Wigan County Borough Council—the MAYOR (Mr. Woods) presiding—the annual statements were made respecting the operations of the gas and water undertakings.

Mr. HOLMES, in moving the confirmation of the minutes of the Gas Committee, referred to the decline of the cotton industry of the town. When they looked back, he remarked, and saw the way in which mills had been closed or taken down, and the exceptionally small number that had been erected on more modern ideas, it made them almost feel that the spirit of enterprise was sadly wanting among the townsmen; for had the number of mills that existed ten or fifteen years ago been now in full work, a much greater demand would have been made on the gas-works, and the revenue would have increased in proportion. The net profits received from the gas undertaking during the past seven years were as follows: Commencing with the financial year ending March, 1886, £865; March, 1887, £3573; March, 1888, £3705; March, 1889, £6202; March, 1890, £10,646; March, 1891, £11,111; March, 1892, £9140. These were exclusive of all interest, sinking fund, and other taxes and charges brought against the works. The increased capital invested in the undertaking had grown from £230,000 in 1886 to £306,000 at the present time. The total net profits this year equalled a gain to the town of £9140, or nearly 3 per cent. on the capital invested, after paying all other charges. During the year several important additions to the gas-works, under capital charges, had been made—viz., a new sulphate-house, smithy, stables, boiler-house, and locomotive-shed, together with an extension of the boundary wall. Considerable extensions and repairs of the mains had also been effected for the better supply of Scholes, Haigh, Aspull, and Higher and Lower Ince, amounting in the aggregate to above 4½ miles in length, and varying in diameter from 2 inches to 18 inches. Connections had been laid on for a new governor to supply Higher and Lower Ince as a separate district; and this would require the erection of a new governor-house. The works were now capable of carbonizing 144 tons of coal and cannel a day; and the present number of retorts was 252, producing 1,612,000 cubic feet per day. The maximum daily consumption in the short dark days in the past year was 1,670,000 cubic feet, or 58,000 feet more than the works were at the present time calculated to yield. When they took a casual review of the actual increase in the sale of gas for the past five years, commencing with the year ending March, 1888, they found in that year an increase of 1·11 per cent. over the previous year; in 1889, 1·85 per cent.; in 1890, 4·92 per cent.; in 1891, 8·12 per cent.; and this year, 10·36 per cent. This clearly showed that an extension of the retort-benches was an absolute necessity, if they were to keep the district of gas supply lighted. Towards this end they had sufficient room in the retort-house; and foundations were already laid for an additional 140 retorts. The carbonizing power of these would be 80 tons, yielding 890,000 cubic feet more gas per day, and thus bringing up the producing power to 2,508,000 cubic feet, or about 51 per cent. in excess of the maximum daily consumption. The unaccounted-for gas had steadily decreased from 9·51 per cent. in 1886 to 4·84 per cent. in 1892. The present system of gas-making was adopted in 1887; and it continued to give very good results—the make of gas per ton of coal and cannel carbonized averaging 11,355 cubic feet of 18¼-candle power. The number of new consumers registered during the past year was 608; and this was, without doubt, due in great measure to the abolition of meter-rents and charges for service-pipes

and fittings. There was one more point to which he felt bound to draw attention; and it was the only one which could not be regarded with satisfaction. There had been a somewhat large falling off in the consumption of gas outside the mile radius; and it equalled 2,161,800 cubic feet, or 5·37 per cent. This opened up a serious question as to whether this was to be allowed to go on, or whether such a reduction should be made in the price to the out-districts as would enable the Committee to draw them more in touch with them. He had no doubt that, should a reduction be decided upon, the Corporation would in the end be the gainers. This, he felt, was a matter which should be dealt with at an early date.

Alderman HOPWOOD, in seconding the motion, said he had had the honour of being Chairman of the Gas Committee for upwards of twelve years; and the leakage then was 30 per cent. It was only through the efforts of their late Manager (Mr. J. G. Hawkins) and their present one (Mr. J. Timmins) that the percentage had been reduced.

Mr. HOLMES, in reply to a question, said the amount handed over towards the rates was £12,000; but the net profits were only £9140, and the other portion had been added from the reserve fund (which was only created last year).

Some discussion ensued with regard to the expenses of a deputation (consisting of four members) who had visited various gas-works with the view of inspecting the retort-house arrangements; and an amendment was proposed that the expenses over and above those of three members be not allowed. This, however, was negatived, but by only one vote—ten members being in favour of it, and eleven against.

The minutes were than formally confirmed.

Mr. RIDDLESWORTH, in moving the adoption of the minutes of the Water Committee, said last year was the first since the commencement of the water-works that they had paid their way; and he hoped in the future they would be able to do something towards paying the other expenses connected with the Corporation. It appeared that last year the amount of the revenue was above £10,000. He thought it was satisfactory to know that the undertaking, which had been a burden on the Corporation so many years, had at last got into a proper position. He could not pass over this matter without saying that the present Chairman of the Water Department (Mr. Alderman Richards) had devoted a great deal of time to its work; and he thought it was through his influence, and the way he had worked, that they were placed in their present position.

The minutes were adopted.

Eight-Hour Shifts at the Rotherhithe Gas-Works.—At the Rotherhithe station of the South Metropolitan Gas Company, where since the strike the men have worked under the eleven-hour system, a notice has been issued stating that from yesterday the eight-hour system would be adopted.

Winding Up of the Heywood Chemical Company, Limited.—Mr. Justice Stirling had before him, a short time ago, a creditor's petition for a winding-up order in respect of the Heywood Chemical Company, Limited. After its presentation, the Company passed a resolution for a voluntary winding up; and his Lordship has now ordered that this should be continued under the supervision of the Court.

The Birmingham Water Scheme.—Owing to the crowded state of our columns this week, we are unable to continue the report of the proceedings before the Parliamentary Committee on the Birmingham Water Bill. The inquiry was closed last Friday, when the preamble of the Bill was declared to have been proved. For the purposes of their water scheme, the Corporation are authorized to borrow £6,600,000; and power is also given to them to make 3¾ miles of railways in Wales "to facilitate the construction and maintenance of the water-works." The clauses of the Bill will be considered to-day.

Cooking by Gas at Newport (Mon.).—Notwithstanding the proximity of the town of Newport to the coal-fields, cooking and heating by gas are popular. On the occasion of the distribution of prizes to members of the Athletic Club by Lord Tredegar, in the Albert Hall, last Thursday, a banquet, the *menu* of which was varied and *recherché*, and at which 251 guests sat down, the entire cooking was done by gas, and gave the utmost satisfaction. An ante-room was improvised as a kitchen, in which were placed the cookers properly hooded and flued. No one in the hall was aware of the presence of the gas-ranges, so efficient were the ventilating arrangements. The entire work was carried out by the Gas Company; the cookers being supplied by Messrs. Wright and Co., Limited.

The Suburban Districts and the Metropolitan Water Supply.—At the meeting of the Bromley Rural Sanitary Authority last Friday, the Clerk reported that the Joint Committee of the representatives of the Local Boards of Bromley and Beckenham and the Bromley Rural Sanitary Authority had drawn up a statement to be laid before the Royal Commission on Water Supply. It stated that these authorities "desire to urge that under no circumstances should their districts be called upon to contribute any portion of the expense which may be incurred in obtaining water from sources of supply other than those at present utilized, nor should the rates be raised in consequence of such additional supply. To tax the inhabitants of a district which has an ample quantity of water at its feet, for bringing an additional supply either to that district or to an adjoining district, would be almost inequitable. The Bromley and Beckenham Local Authorities respectfully urge (1) that, having regard to future local requirements, no water can be spared from that part of the Kent chalk which underlies their respective sanitary districts, for the needs of other localities; and (2) that if the undertakings of the Kent and Lambeth Companies are acquired by a Metropolitan Water Authority, either by compulsion or agreement, the local authorities shall be entitled to purchase from the Authority, on fair terms, but without profit, so much of the undertakings of the Companies as relate to their respective sanitary districts. The object of the Bromley and Beckenham Authorities is to have the water supply in their own hands, and to afford the inhabitants of their district a constant and plentiful supply of pure water at the very lowest cost." After the report had been considered, it was decided to withdraw the opposition to the Bill promoted by the London County Council.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Although the fact has not been in any way made public as yet, I am able to state that the Edinburgh "sensation" which I have been obliged to refer to in my "Notes" for the past two weeks, has fallen altogether flat. No one has taken the least notice of it; and, what is of more importance, the Works Committee of the Gas Commission have resolved that they will not do so. I understand that Mr. Mitchell made an explanation of the circumstance, which was regarded as quite satisfactory—that a bench of retorts is being renewed, and the work has been entrusted to the contractor who erected it. Nothing could be more natural; and the wonder is that any newspaper should have been so easily befooled as the *Scotsman* was. The belief gains ground that the author was a Gas Commissioner; and his conduct is being universally condemned as "a very dirty trick." When the minutes of the Works Committee are laid before the Commission, the subject will likely be mentioned. It will be interesting to observe if there be any vacant chair at the next meeting, as we have seen before when a Commissioner who had erred in the matter of rushing into the press what should have been kept private, was afraid to face his colleagues.

In the present lull in the agitation upon the question of liability for providing light in common-stairs, it may be stated that the Corporation of Edinburgh have taken the opinion of Mr. Cowrie Thomson, advocate, the senior Legal Assessor for the city, as to their powers in the matter of cleaning, lighting, and extinguishing lights in common-stairs; and that the opinion of Counsel is that with their present powers the Council cannot undertake a universal system of lighting common-stairs and charge it upon the rates, but that each case must be specially adjudicated upon. This means that, until application is made to Parliament, the present system, under which the occupiers are required to do the work, must be maintained.

An exhibition of gas appliances was opened at Dumfries on Monday. The appliances shown are those of Messrs. H. Darwin and Co., of London and Glasgow. One-man exhibitions of gas appliances are becoming the order of the day—a state of matters quite different from what prevailed in the early days of gas exhibitions, when there was, if not competition, at least a choice of apparatus at the command of the visitors. As is now the fashion, practically illustrated cookery lectures were given during the week, which is probably the best method of advertising gas-stoves. The lecturer was Miss Phillips, late of the South Kensington School of Cookery.

The proposal to form a combination among gas-owning bodies in the Forfarshire district, for the purpose of taking over the Elliott works of Messrs. John Dobbie, Sons, and Co., and working them as a joint undertaking in the treatment of residuals, is, I fear, not to become a reality. The Arbroath Gas Corporation met on Thursday night and rejected the scheme; only one member being in favour of it. I confess that I lean to the view expressed by Mr. Cargill, who moved its rejection, that disputes would be likely to arise between the parties carrying on the works as to quality of the liquors delivered by them and the allocation of the returns. Bailie Mackintosh, his seconder, added a more cogent reason—the undertaking is not within the powers of the Corporation. The strongest plea for a joint refinery is that it would enable them to get rid of the middleman. Yet a joint refinery would require management; and the management of such an undertaking would be open to so many abuses that it is doubtful whether the cost would not be greater than the profits of the middleman. It would be an interesting experiment were the scheme to go on. But the capital of gas-works is not raised for the purpose of experimenting at large; and that consideration alone is sufficient to prevent Mr. Tait's proposal being entertained.

Last week, I wrote of the resolution of the Hamilton Town Council to proceed with the extension of the Corporation Gas-Works. This week, I have to record the death of Mr. John Johnstone, the Manager of the works. Mr. Johnstone was in business on his own account as a blacksmith, when, in 1877, he was appointed Manager of the gas-works. He has proved himself to be a capable manager. One of his first duties was to devise and superintend an extension of the works which almost doubled their capacity. He has lived to see the works flourish under him till another extension is necessary; and his removal at this time, when his advice would have been of much advantage to the Corporation, is matter of regret. His death, which took place on Monday morning, resulted from lung disease of long standing.

I am glad to be able to announce that the Dunbar Gas Commissioners, of whose doings, amounting almost to persecution of Mr. Cuthbert, their Manager, I have had occasion to write more than once recently, show signs of returning to reason; and it is also a pleasure to have to record that Mr. Cuthbert is getting the better of his oppressors. The Commissioners have this week held a meeting, at which there was no recrimination, nothing of the nature of a "scene," but everyone seemed to be imbued with a desire to do his best for the undertaking they manage. At their previous meeting notice was given of a motion that Mr. Cuthbert should be dismissed, because he would not weigh the coal upon a small weighing-machine. A steelyard of satisfactory dimensions is now to be provided; and Mr. Cuthbert will doubtless use it to the advantage of the Commissioners.

The report by Professor Kennedy on the proposals of Messrs. Urquhart and Small for the electric lighting station in Dundee, has been received. It is just as I expected; the Gas Commissioners might have saved the fee which they will have to pay to the Professor. The system which the engineers propose is the same as he has employed in London for some years, and "upon which he is now carrying out the lighting of Glasgow." As becomes a superior person reporting upon the work of inferiors, he suggests one or two variations in the details of the proposals; and in conclusion he gives his opinion that the scheme of Messrs. Urquhart and Small is "a well-thought-out scheme, and one of a type which has been thoroughly tested and found to be efficient and economical in practical work." A meeting of the Gas Commissioners is to be held on Tuesday to consider the report, and to determine the action of the Commissioners upon the scheme.

In these days of eight-hour day agitation, it is not surprising that

municipalities have the subject brought before them. In the Glasgow Police Commission on Monday, Mr. Tait, the gentleman who directed the Scotch railway strike, moved for the appointment of a Committee to inquire if all the Corporation employees should not be placed upon an eight-hour working day. His chief argument was that the employees in the gas-works already work upon an eight-hour shift. The Commission, by 30 votes to 11, agreed to the appointment of a Committee; but several of the speakers pointed out that they supported the proposal merely because it was one for inquiry. Although he got the Committee appointed, Mr. Tait himself appeared to look upon his proposal as a hopeless one.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 14.

Sulphate of Ammonia.—The markets generally are extremely dull, and there is a great stagnation of business. This is especially perceptible at the East-coast ports, where the shipments show a decided falling off. The local market keeps fairly steady; and among the exports are again noticed some American shipments. A resumption of the demand for the latter country would be a welcome factor at the present juncture, and might prevent the downward tendency. Quotations are £10 f.o.b. Hull, Leith, and Liverpool. Nitrate has declined to 8s. 6d. per cwt.

LONDON, *May* 14.

Tar Products.—The contrast between the value of products to-day and what they were about this time last year is simply astounding; for, whilst benzol was then difficult to obtain at 4s. 6d. per gallon, its selling value to-day is only 1s. 6d. Anthracene, creosote oils, and other important products have all shared in the same extraordinary collapse. Benzol for forward delivery is quotable 1d. higher. Business is said to have been done in "A" anthracene at 11d.; whilst the value of "B," according to quality, varies between 6d. and 9d. There is a little more inquiry for tar oils; and prices are slightly firmer. There is a distinctly better feeling as to the future of pitch; and buyers are beginning to see that the production for next season is not likely to be in excess of what is required. It is now thought that, instead of receding in value, pitch will probably be dearer in the autumn. Important tar contracts have been let at prices, ranging according to quality and position, from 10s. to 13s. per ton. Other prices are: Pitch, 27s. to 30s. Benzol, 90's, 1s. 7d.; 50's, 1s. 3½d. Toluol, 1s. 2d.; Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—This market is utterly devoid of any life; and business drags. It is difficult to obtain more than £10 less 3½ per cent. The production is now decreasing rapidly; and as stocks are not large, it is hoped that lower prices will not be touched this season. The outlook, however, is far from encouraging. Gas liquor (10-oz.) sells at 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is a continued steadily lessening demand for all descriptions of round coal; and although stocks are not accumulating to any appreciable extent, very many of the collieries are not working more than four days per week. For house-fire consumption, requirements are necessarily rapidly diminishing; but so far, the output of the better qualities of round coal have been moving away without difficulty, and prices have been well maintained. At the pit mouth, best Wigan Arley is still quoted at 12s. 6d. per ton; but the second qualities of house coal are easier, and scarcely average more than about 10s. 6d. per ton for Pemberton four-feet and second qualities of Arley, and about 9s. per ton for common house-fire coals. The lower qualities of round coal are hanging upon the market, owing to the depressed condition of the principal coal-using industries; and requirements, for iron making, especially, are only very indifferent. The shipping trade also continues extremely quiet; and with plentiful supplies offering in the market, prices continue to ease down, although there is no actually quotable reduction in list rates. For inland requirements, good ordinary descriptions of steam coal scarcely average more than 8s. to 8s. 3d. per ton, at the pit mouth; whilst for shipment, ordinary qualities of steam coal have been offering freely, for delivery at the Garston Docks or the High Level, Liverpool, at about 9s. 3d. to 9s. 6d. per ton. With the resumption of work at the cotton mills, there has been a better demand for engine classes of fuel; but supplies of these are still in excess of requirements, and low prices are quoted in the market. At the pit mouth, burgy averages about 6s. 6d. to 6s. 9d. per ton; best slack, 5s. to 5s. 6d.; and common qualities, 3s. 6d. to 4s. per ton.

Northern Coal Trade.—There are fuller supplies of coal in the northern markets, several of the smaller pits having commenced working; and this, and the expectation of an early general resumption of work, has caused the prices of coal generally to fall. Best Northumbrian steam coal, which had been sold at 13s. per ton, f.o.b., has fallen about 1s. 6d. per ton for prompt delivery, and is quoted at 1s. per ton less for delivery in a week or so; whilst for more forward delivery a lower rate is asked. Small steam coal, which had been sold as high as 10s. per ton, has fallen to about 7s. 6d., and must fall further. Indeed, the effect of the resumption of work at the Durham collieries is already being anticipated as far as prices are concerned, though it must be some time before a full resumption of work takes place. Gas coal is now being produced at several of the smaller unassociated collieries that started a week or so ago; and the limited summer needs of the local gas companies are being well met. About 10s. 6d. per ton, free on rails, was paid last week for unscreened gas coal; and lower prices will now soon rule, for the output will increase steadily for some time. Bunker coal has also fallen in price, and household coals are flat. Gas coke is dull; but there has been a larger consumption, some of the companies having almost cleared out their stock. Blast furnace coke is still scarce, though the production is being now increased very steadily. Prices as high as 25s. per ton have been paid for coke; but it may be hoped a return to more normal rates will soon be known.

Scotch Coal Trade.—In the West of Scotland, the coal market has retained a steady tone, due on the one hand to the re-starting of steel furnaces, and on the other to heavy shipments to Mediterranean ports, chiefly of gas coal. The miners are disposed to kick at the reduction of wages which is imposed upon them; but, though one or two pits threaten to strike, the movement is by no means general, and the idle day a-week has little perceptible effect on the market. In the east of Scotland, trade has been slow and flat, the prospect of a settlement of the Durham strike having a tendency to limit the demand. Prices have been maintained in both east and west; but with the resumption of work in Durham, there is every prospect of a fall. The quotations this week are: Main, 7s. 6d. to 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d. to 8s. 6d.; and steam, 10s. to 10s. 3d. per ton. The shipments were 170,369 tons—an increase of 4973 tons over the corresponding week of last year. For the year to date, the shipments from Scotch ports have been 2,290,279 tons—an increase of 277,770 tons upon the shipments in the same period in 1891.

The Fire at the South Metropolitan Gas-Works.—We learn that the fire at the Old Kent Road station of the South Metropolitan Gas Company, to which reference was made in the JOURNAL last week, was not so serious as at first reported. The damage consisted only of the roof of the Board-room in the old office, which was used as a meeting-room by the workmen. It is a single-storey building. As at the time of the fire, the night shift of stokers happened to be coming in, they set to work with the Company's fire-engine, and obtained the mastery of the fire before the Brigade arrived.

Lambeth Water Company.—The report of the Directors of this Company for the half year ended March 31 last, shows an increase of £1135 in the water-rents, &c., and a decrease of £971 in the expenditure, as compared with the six months ended March 31, 1891. The surplus transferred from revenue account to dividend and interest account is £67,256. There is to the credit of the latter account, after payment of interest on debenture stock, an available balance of £62,299. The Directors propose to transfer a further sum of £2750 from the contingency fund to the credit of this account, and thereby increase the available balance to £65,049. Out of this, they recommend to the proprietors the distribution of the maximum dividend at the rate of 7½ per cent. per annum on the shares issued under the Company's Act of 1856, and a dividend at the rate of 9½ per cent. per annum on all the other share capital of the Company—all less income-tax. These will amount to £64,813, and a balance of £236 will remain to be carried forward.

Action as to the Sale of a Gas-Stove.—At the Westminster County Court last Wednesday, an action was tried in which The Gaslight and Coke Company sought to recover £5 3s. 3d., the value of a gas-stove, together with £1 as compensation for its detention and the loss of rent thereon. In 1890 the Company let a stove to a Mr. Haslingdon, of 26, Sydney Street, Chelsea. Subsequently a distress was put in by his landlord, and a stove was seized and sold. The plaintiffs contended that the stove was their property, and that the seizure was illegal, as, according to the judgment in *The Gaslight and Coke Company v. Hardy*, the stove must be regarded as a "fitting." Evidence was given as to the sale of a heating-stove for 5s.; but it was stated that there was no badge upon it to show that it belonged to the Company. A cooking-stove bearing such a badge was left at the house. It was urged by Mr. Neville, on behalf of the plaintiffs, that they were not bound to put a label on their stoves. In the result, the Judge (Mr. F. Bayley) said he was not satisfied that the stove sold really was the Company's; and he gave judgment for the defendant, with costs.

The Action of Liverpool Water on Lead.—Dr. J. Campbell Brown has submitted a report to the Water Committee of the Liverpool Corporation, in which he states the results of some experiments he has made on the action upon lead of filtered and unfiltered water from Lake Vyrnwy and of a sample of Rivington water. The water was allowed to stand on sheets of lead for five days; and the amount of lead dissolved was then estimated. The results were as follows: Unfiltered Vyrnwy water: Parts of lead dissolved in every 100,000 parts after five days, ·8; total solids in solution, 3·76; reaction, slightly acid. Filtered Vyrnwy water: Parts of lead dissolved, ·08; solids in solution, 6·68; reaction, neutral. Rivington water: Parts of lead dissolved, ·23; solids in solution, 8·76; reaction, slightly acid. The unfiltered Vyrnwy sample Dr. Brown says, would be objectionable for public supply; and the filtered sample, on the other hand, takes up less lead than ordinary Rivington water. The cause of the action upon lead is twofold: (1) The peaty matter in the water; and (2) the acidity of the water. Filtration removes the greater part of the first cause, while the second cause can be remedied either by admixture with a sufficient proportion of alkaline water, or by the addition of a small carefully calculated quantity of either milk of lime or soda ash previous to filtration. Mr. J. Parry, the Water Engineer, has also submitted a report to the Committee, in which he deals with that of Dr. Campbell Brown. He says that the reduced action of the filtered Vyrnwy water on lead, as compared with that unfiltered, is partly due to the influence of the limestone tunnels through which the water flows at Cynynion and Llanforda, as well as to the effect of passing through the sand filter-beds. With regard to the action of the Rivington water upon lead, he reminds the Committee that, when public attention was called to this subject in 1886, through the reports of lead-poisoning in Huddersfield and Sheffield, he submitted to Dr. Brown samples of water drawn from new lead-pipes in various parts of the city district after standing for over twelve hours in contact with the lead. Dr. Brown then reported that in districts supplied with well water, and with mixed Rivington and well waters, there was no trace whatever of lead; and in the few districts supplied wholly with unmixed Rivington water, only a slight and unimportant trace of lead was discovered. No unmixed Vyrnwy water has yet been supplied to the city.

The Gas Question at Bideford.—On the recommendation of the Lighting Committee, the Bideford Town Council last Thursday resolved to advance their offer of £14,000 for the Gas Company's works to £15,000.

The Willenhall Local Board and the Gas-Works.—At the meeting of the Willenhall Local Board yesterday week, a Committee was appointed to inquire as to the desirability of acquiring the gas-works on behalf of the ratepayers.

West Bromwich Gas Supply.—The quantity of gas sold by the West Bromwich Corporation Gas Committee during the year ended March 31 last was 203,780,700 cubic feet, as compared with 201,319,700 cubic feet in the previous year—an increase of 2,461,000 cubic feet. The amount of gas-rental for private and public lighting was £25,860, compared with £25,550 the previous year—an increase of £310.

Another Artesian Well in the City.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday, the Medical Officer of Health (Dr. Sedgwick Saunders) reported that a well had been sunk in Broad Street House, by Messrs. Docwra and Sons, to a depth of 400 feet. The supply capable of being raised daily was stated to be 30,000 gallons; and an analysis of the water showed it to be of great purity.

Winding up of the Pamplona Water-Works Company, Limited.—In the Chancery Division of the High Court of Justice last Saturday, Mr. Justice Kekewich heard a petition for the winding up of the above-named Company. Mr. Eustace Smith said the petition was presented by a judgment creditor who was the holder of debentures on which interest was in arrear. Bondholders to the amount of £5500 supported the petition. His lordship asked if the Company opposed; and on being informed that they were not represented, he made the usual winding-up order.

Bolton Corporation Water-Works.—The accounts of the Water Committee of the Bolton Corporation for the financial year ended in March last show that a profit of £11,100 has been earned and handed over to the borough fund in relief of rates, as against £11,675 in the previous year. The total income was £53,619; the principal item being £31,565 for water supplied for domestic purposes. The expenditure amounted to £40,518, as against £38,277 in the previous twelve months. Maintenance of works took £4644; salaries, £1850; rents and rent-charges, £1380; rates and taxes, £3002; interest, £24,710; sinking fund, £2414; and instalments of loan paid off, £1990.

Haverhill Local Board Gas Supply.—According to the accounts of the Haverhill Local Board Gas Department for the past financial year (to March 25), the gas supplied produced a net revenue of £1769; residuals stand for £281; a sum of £78 was received from the Board for the supply of steam, &c.; and the total receipts were £2176. The outlay for coals was £996; wages and gratuities at works came to £239; and interest on loans, to £219—the total expenditure being £1731. There was consequently a profit balance of £445. The instalment and of loans, repaid in the year amounted to £153. The working statement of the Manager (Mr. B. Gibson) shows that there were 848 tons of coal carbonized, and 8,900,000 cubic feet of gas made. Of this quantity, 7,363,800 cubic feet were employed in private lighting, 519,000 cubic feet were used in the 73 public lamps, and 218,800 cubic feet on the works; making 8,101,600 cubic feet accounted for, and leaving 798,400 cubic feet, or 8·9 per cent. The make of gas was at the rate of 10,495 cubic feet per ton of coal carbonized.

Malta and Mediterranean Gas Company, Limited.—The accounts of this Company for the year ended March 31, 1892, are of a satisfactory character; there having been a general increase of rental. At the Corfu and Sicilian stations, the price of gas to private consumers has been reduced; and there has been an improvement in the sale of residuals and fittings. According to the profit and loss account, the revenue amounted to £34,695; and deducting the expenditure, there remains a balance of £10,678. The distributing plant at Malta has been increased by the enlargement of the leading main, and by an extension of mains to Sliema—a populous suburb of Valletta. To meet this outlay, the loan capital has been increased by the issue of £6300 additional debentures. After providing for dividends on the preference capital, the Directors recommend that a dividend of 4 per cent. be declared on the ordinary capital, which, added to the interim dividend already paid, will make a total of 6 per cent. for the year, leaving a balance of £2412 to be carried forward. The Directors announce the death, on Nov. 7 last, of their valued colleague, Mr. Charles Newton; and to fill the vacancy, they have elected Mr. Stephenson R. Clarke for the remainder of the period for which Mr. Newton was elected.

Liverpool Gas-Fittings Company.—At the annual meeting of this Company last Wednesday, the Chairman (Mr. J. B. Smith) had the pleasure of presenting to the shareholders a very satisfactory report on the working of the past year. The turnover, he said, had been much in excess of the previous year—being £25,697, against £21,181; and the profit was £2081, as against £1451. This enabled the Directors to pay, in addition to the ordinary dividend of 10 per cent., a bonus of 5 per cent., which had been withheld during the last three years, at the same time leaving £581 to be carried forward, as compared with £451. The main reason of this was that there had been a great increase in the sale of automatic meters. Apart from this, however, competition was as keen as ever; and they had to be content with small profits in order to get business. They could not calculate, perhaps, upon the sale of the automatic meters continuing on the same scale; but for some time there was no doubt there would be a considerable demand for them. It was a question whether the system, which had been working so satisfactorily, might not be still further extended. He understood that a company was about to light a village with gas; and that the whole supply was to be paid for by means of these meters. There was another Company coming out, to be called the Automatic Gas-Meter Company, for the purpose of extending this business; and he might add that their Manager, Mr. Haynes, had succeeded in producing some very valuable patents, of which the new Company would have the advantage. The report and recommendation as to dividend were adopted.

The Electric Lighting Question at Taunton.—The report prepared by Mr. Gisbert Kapp, M.Inst. C.E., on the value of the buildings and plant of the Taunton Electric Lighting Company (see *ante*, p. 861), came before the Town Council last Tuesday; and, after considering it, they arrived at the following decisions: That steps should be taken to obtain a Provisional Order; that for the present the system now in use (the Thomson-Houston) should be continued; and that a Sub-Committee should be instructed to negotiate with the Company for the purchase of the works on the basis of Mr. Kapp's valuation, and make arrangements for carrying them on until an Order is obtained.

The Blackpool Corporation Gas-Works.—Under the management of Mr. J. Chew, the Blackpool Corporation Gas-Works make excellent progress. During the year ending March 25, the production of gas was 193 million cubic feet—an increase of 29 millions over the previous year. The revenue was about £30,000. The capital expenditure by the end of the present year will have reached £100,000. It is intended to further extend the works, and complete the alterations now in progress as early as possible. It is expected that when the alterations are finished, they will be able to make 150 million cubic feet more gas per annum. Coal cost the Corporation £600 more in the year just closed than it did in the previous one; and owing to the fall in the price of coke, there is a diminution of between £300 and £400 in the receipts under this head.

The Annual Report of the Stafford Corporation Gas Committee.—The Gas Committee of the Stafford Corporation submitted their annual report at the meeting of the latter body last Tuesday. It appeared therefrom that, notwithstanding the great fall in residuals in the past year, the gross profits had been above £8000, and the net profit £2500. They recommended that £500 should be carried to the reserve fund, £1500 paid to the district fund account in reduction of the district rate, and £500 to the borough fund, to enable the Baths Committee to completely equip the baths without any further charge on the rates. The Committee proposed that for the future no charge should be made for meters, and that there should be a sliding scale of discounts, in order that large and small consumers alike might benefit to an equivalent of nearly 2d. per 1000 cubic feet reduction on the present prices. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 913.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½–17½	..	6 0 0
100,000	10	,,	7⅛	Do. 7 p.c	10	11–12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	10–12	–2	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6½–6¾*	..	5 11 1
40,000	5	,,	7½	Do. New	4	4½–5*	..	6 0 0
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	210–215	..	5 14 1
150,000	,,	,,	9½	Do. New	100	160–165	..	5 12 2
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40–42	..	5 9 6
888,500	Stck.	11 Mar.	5	Bristol	100	95–100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42–44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½–15½	+½	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	7–8	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94–97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25–27	..	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	229–234	–1	5 11 1
165,000	,,	,,	10	Do. New do.	100	180–190	..	5 5 3
130,000	,,	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118–123	..	3 13 2
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	221–226	..	5 15 1
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190–195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185–195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19–20	..	5 0 0
354,060	10	,,	10	Do. Partly paid	7½	13½–14½	..	5 3 11
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	213–217	+8½	5 10 7
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94–97	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	247–252	..	3 19 4
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116–121	..	4 2 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	169–174	..	4 6 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	153–156	..	4 9 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	245–250	..	4 0 0
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	146–150	..	4 0 0
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114–116	+½	3 9 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	118–123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	163–169	+1½	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	218–222*	..	5 8 1
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4–4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	107–109	+1	4 11 9
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½–15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8–8⅜	..	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4–5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2–3	..	—
420,000	100	3 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	102–105*	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	103–106	..	5 13 2
150,000	10	15 Oct.	10	San Paulo, Limited	10	8–9	–⅛	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	275–280	..	5 10 8
1,350,000	,,	,,	12	Do. B do.	100	218–223	+1	5 7 7
200,000	,,	,,	13	Do. C do.	100	235–240	..	5 8 4
725,000	,,	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142–146	+1½	3 8 6
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225–230	..	5 0 0
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	252–257	..	3 17 9
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	195–200	+2	4 0 0
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136–140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	96–99	..	4 0 10
708,000	Stck.	12 Feb.	10½	Kent	100	255–265	+5½	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	220–225	..	4 4 5
406,200	100	,,	7½	Do. 7½ p. c. max.	100	185–190	..	3 19 0
279,700	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120–123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	320–330	..	3 13 6
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	126–129	..	3 2 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	145–150	..	6 6 8
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	133–138	..	5 14 3
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	244–248	+1½	4 0 8

*Ex div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

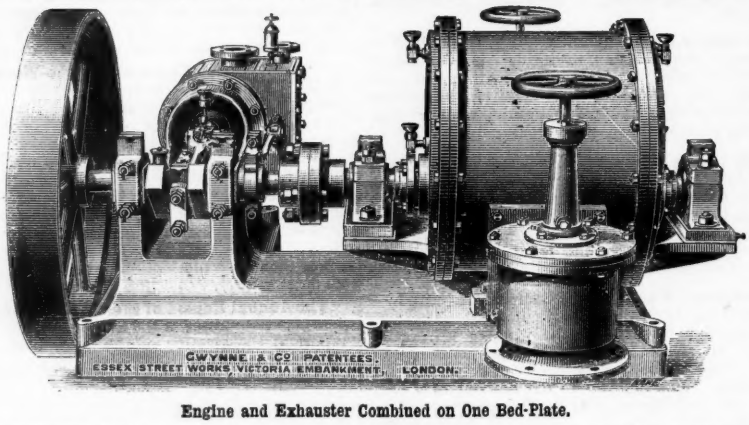
HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKE CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

WINKELMANN'S "Volcanic" Fire CEMENT. (Fire resistance, 4500° Fahr.)
Prices, particulars, and directions for use on application to ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C.

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JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

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JAMES GORDON & Co., Brokers, can offer Cargoes of good quality; also 2500 tons of SPENT OXIDE.
Samples and price on application.
Address Borough Buildings, 7, Rumford Street, LIVERPOOL.

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BROTHERTON AND Co., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

LIQUID FUEL.

TAR Oils, Naphthalene, Oil Residues, Tar, Petroleum, &c. SADLER'S PATENT BURNER is the simplest and most effective. No smoke; no Ashes.
For particulars and price of Burner and Cheap Oils, apply to SADLER AND Co., LIMITED, MIDDLESBROUGH.

BOG ORE.

SEVERAL Hundred Tons in fine dry condition for shipment at Londonderry.
Apply to S. M. MACRORY, Steam-Mills, LIMAVADY.

WANTED, by a Manager (age 38), the MANAGEMENT of a GAS-WORKS making from 5 to 12 million cubic feet, or could take Management and Secretaryship. Nineteen years' practical experience. Good Testimonials and References.
Address, No. 3098, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
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Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. I., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
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INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
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GAS-FITTER and Bellhanger wanted.
Apply to W. BATCHELOR, 35, Warwick Street, LEAMINGTON.

WANTED, for a Gas-Works, a steady man as STOKER. Preference given to one who has had practical experience. Wages 25s., per week. Permanent situation to a suitable man. State age.
Apply, with references, to the MANAGER, Gas-Works, Leatherhead, SURREY.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OLPHERT'S OXIDE.

FINEST Quality of Natural Bog Ore
Apply for particulars to the Sole Agent, Mr. THOS. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OIL for the "Wells" or "Lucigen" Lamps.
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COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. III., centre of JOURNAL.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

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LUX'S Gas Regulators for every consumption.
LUX'S single-stem Pressure-Gauges.
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THE Sharon Chemical Company, Ltd., Derby, are buyers of AMMONIACAL LIQUOR and Sellers of TAR and SULPHURIC ACID. They frequently buy, sell, hire, or let Railway TANK-WAGONS. Correspondence invited from persons interested.

TAR-WORKS.

ADVERTISER wishes to Lease or Rent a small or medium-sized TAR or SULPHATE WORKS.
Apply, by letter, stating terms and particulars, to No. 2101, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CLERK.

WANTED, at the Cheltenham Gas-Works, a CLERK. Must be experienced in Coke Sales, Fittings and Stores Books, &c. Commencing salary, 34s. per week. Guarantee for £200 required in an approved Insurance Office.

Apply, stating age, with copies of two recent testimonials, to Mr. R. O. Paterson.

Gas-Works, Cheltenham,
May 7, 1892.

EAST DEREHAM LOCAL BOARD GAS-WORKS.

WANTED, a Competent Man as Stoker, and to make himself generally useful. One used to Shovel Charging and Regenerative Furnaces, and a Total Abstainer preferred.

Apply, with testimonials, to

A. DRAGE,
Manager.

Gas-Works, East Dereham,
Norfolk.

KETTERING WATER-WORKS COMPANY.

TO PLUMBERS.

WANTED, a practical Plumber (R.P. preferred) as Water-Fittings Inspector, &c. Wages, 28s. per week.

Applications, in own handwriting, stating age, with copies of recent Testimonials, to be addressed to the undersigned by the 21st of May.

T. A. SIMPSON,
Secretary and Manager.

4, Newland Street, Kettering,
May 13, 1892.

BOLTON CORPORATION.

(GAS DEPARTMENT.)

WANTED, a General Foreman for the Lum Street Gas-Works. Make of Gas per annum, about 400 millions. Salary, £3 per week. Candidates to state age and previous experience.

A copy of the duties may be obtained from Mr. W. Smith, Engineer, Lum Street Gas-Works, Bolton.

Applications, together with not more than three recent Testimonials, to be addressed to Mr. Alderman Miles, Chairman, and delivered at the Gas Offices, Bolton, not later than Thursday, the 26th of May, 1892.

By order,
R. G. HINNELL,
Town Clerk.

Bolton, May 10, 1892.

GASHOLDER AND CONDENSERS FOR SALE.

THE Great Yarmouth Gas Company have FOR DISPOSAL a GASHOLDER, with Cast-Iron Tank complete; also a set of CONDENSERS in good condition.

Further particulars can be obtained on application to the Engineer.

GAS-METERS FOR SALE.

THE Royal Agricultural Hall Company, Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.

Apply to R. VENNER, Secretary, Royal Agricultural Hall Company, Limited, ISLINGTON.

FOR SALE—Thirty-five 3-inch Cast-Iron Flange and Spigot STOPCOCKS, in first-class order.

Address No. 2100, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—The Redhill Gas Company have FOR DISPOSAL a 15,000 feet BEALE'S EXHAUSTER in good working order. Price, £25. Can be seen at any time on application to the undersigned.

C. READ, Manager, &c.

FOR SALE—Freehold Manufacturing PREMISES in Birmingham (Engine power, Substantial Shopping, Spare Land) in main thoroughfare, near G. W. and L. N. W. Railway Companies' Stations. About £8500. Owner relinquishing through ill-health.

Apply, by letter, to No. 2099, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE, cheap—Two Gasholders 35 ft. diameter by 12 ft. deep. Capacity, 11,500 cubic feet each. Also various other larger sizes.

Two PURIFIERS, 24 ft. by 16 ft. by 4ft. 6 in. deep, with Valves and Connections. Also various other sizes.

WASHERS, from 500,000 to 250,000 feet per diem.

CONDENSERS, from 500,000 to 10,000 feet per diem.

EXHAUSTERS, from 120,000 to 5000 feet per hour.

STATION METERS, from 100,000 to 1500 ft. per hour.

Would erect any of the above, and make practically equal to new.

Inquiries invited for any second-hand Gas Plant.

Apply to SAML. WHILE (late Ashmore and While), 60, Queen Victoria Street, LONDON, E.C.

MARLBOROUGH GAS COMPANY.

FOR SALE—Useful Plant for small Gas- Works in good condition; removed to make room for larger—

GASHOLDER, with Cast-Iron Tank, Columns, and Lattice Girders complete. Capacity, about 14,000 cubic feet.

STATION METER (Parkinson's), 3600 cubic feet per hour, with 6-inch Connections, and 6-inch (Cockey's) Bye-Pass Valve.

Two 6-inch (Cockey's) Four-Way Valves, with Outlet and Inlet Cylinders and Connections.

Inspection and TENDERS invited.

Any further information can be obtained upon application to the undersigned.

JOSEPH PHELPS,
Engineer and Manager.

Gas-Works, Marlborough.

BLACKPOOL CORPORATION.

THE Gas Committee are prepared to receive TENDERS for the supply of about 18,000 tons of COAL and CANNEL for the ensuing year.

Tenders, endorsed outside, to be sent to the Chairman by the 28th of May.

Particulars and Forms of Tender may be had on application to the undersigned.

JOHN CHEW,
Engineer.

Gas Office, Blackpool,
May 12, 1892.

TO LIME MASTERS.

THE Corporation of Walsall invite Ten- ders for the supply of about 600 tons of LIME, which will be required at their Gas-Works during One year from the 1st of July next; the deliveries to be in such monthly quantities as the Manager of the Gas-Works may from time to time direct.

The Lime is to be hand-picked, and clear from Refuse and Ashes, and to be delivered at Walsall Railway Station, or by Boat at Walsall Old or New Gas-Works. In the latter case, it will have to be unloaded.

Payments, monthly.

Tenders, sealed, and marked outside "Tender for Lime," are to be sent to the undersigned on or before Saturday, the 28th of May inst.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 11, 1892.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite Ten- ders for the supply of 34,000 tons of STAVELEY, YORKSHIRE, or any other good GAS COAL, to be delivered during One year from the 1st of July next, either at the London and North-Western or Midland Railway Stations at Walsall, or the Corporation Siding at the Pleck Gas-Works, as may be required.

Forms of Tender and Specification may be obtained on application to the undersigned.

The Corporation do not bind themselves to accept any tender; and they reserve the right to divide the Contract between several Firms.

Tenders, sealed, and marked outside "Tender for Gas Coal," and stating the price for large Coal and also for Nuts, are to be sent to the undersigned on or before Saturday, the 28th of May inst.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 11, 1892.

TENDERS FOR TAR.

THE Corporation of Walsall invite Ten- ders from persons willing to purchase the surplus TAR made at the Pleck and Wolverhampton Street Gas-Works, during One year from the 1st of July next. The Corporation will deliver it into the Contractor's Boats at the Gas-Works. Not more than two Boat loads will be allowed to remain in the Tanks at each Gas-Works at any time.

The price per quantity of 210 gallons to be stated. To be paid for monthly.

Tenders, sealed, and marked outside "Tender for Tar," are to be sent to me on or before Saturday, the 28th of May inst.

Security will have to be given for the performance of the contract.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 11, 1892.

COAL AND CANNEL.

THE Lymm Local Board are prepared to receive TENDERS for the supply of COAL and CANNEL, to be delivered at their Gas-Works, in Lymm, for a term of One year from the 1st day of July, 1892.

The probable quantities required are about 1200 tons of Coal and 250 tons of Cannel, which must be well screened, and free as possible from Bats, Sulphurous Pyrites, or other objectionable matter; but the Board reserve the right of increasing or decreasing the quantities named.

The person whose tender is accepted will be required to enter into a contract, form of which can be seen at the Board Office any Tuesday or Friday between the hours of Ten and Twelve a.m. and Two and Five p.m.

Tenders, stating price per ton, delivered alongside the Works, to be sent to the undersigned on or before the 28th day of May, 1892, endorsed "Coal and Cannel."

Further particulars can be had of the Gas Manager, Mr. W. Severs.

The Board do not bind themselves to accept the lowest or any tender.

The Board have no special form of tender.

W. MULLARD,
Clerk to the Board.

Local Board Offices, Lymm,
May 7, 1892.

TAR AND AMMONIACAL LIQUOR.

THE Lymm Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, for a term of One year from the 1st day of July, 1892 (or for such longer term as may be contracted for, with the consent of the Board).

The Tar and Liquor will be delivered free in Contractor's Boat on the Bridgewater Canal.

Tenders to be sent to the undersigned on or before the 28th day of May, 1892, endorsed "Tar."

The purchaser will have to enter into a contract, form of which can be seen at the Board Office any Tuesday or Friday, between the hours of Ten and Twelve a.m. and Two and Five p.m.

The Board do not bind themselves to accept the highest or any tender.

The Board have no special form of tender.

Further particulars can be had of the Gas Manager, Mr. W. Severs.

W. MULLARD,
Clerk to the Board.

Local Board Offices, Lymm,
May 7, 1892.

TO TAR DISTILLERS AND MANUFACTURING CHEMISTS.

THE Directors of the Wellington (Salop) Coal and Gaslight Company invite TENDERS for the purchase of the surplus TAR to be produced at their Works for One year from the 1st of June next.

Particulars may be obtained from the undersigned, to whom tenders should be sent on or before May 28.

JNO. C. BELTON, Manager.

Gas Office, Market Street, Wellington,
Salop, May 13, 1892.

BOROUGH OF DARWEN.

SUPPLY OF COAL AND CANNEL.

THE Corporation are prepared to receive TENDERS for the supply of 10,000 tons of best GAS COAL, and 4000 tons of CANNEL or CANNEL NUTS, required at their Gas-Works during the ensuing Twelve months.

Particulars, together with printed Forms of Tender, may be obtained on application to Mr. Thos. Duxbury, Gas Engineer, Darwen.

Sealed tenders, which must be on forms so supplied, marked "Tender for Coal" or "Cannel," to be delivered to me by Noon on Monday, the 23rd of May, 1892.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
CHAS. COSTEKER,
Town Clerk.

Town Clerk's Office, Darwen.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas- light Company invite TENDERS for the supply of about 13,000 tons of screened GAS COALS, and about 1000 tons of good English CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the year commencing July 1, 1892, and ending June 30, 1893.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 17th day of June 1892.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1892.

SHREWSBURY GASLIGHT COMPANY.

DISPOSAL OF SURPLUS TAR.

THE Directors of the above Company are desirous of receiving TENDERS for the purchase of the surplus TAR made at their Works during the year commencing July 1, 1892.

The estimated quantity for disposal is about 950 tons per annum.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent in to the undersigned not later than the 17th day of June, 1892.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1892.

RAWMARSH LOCAL BOARD GAS-WORKS.

TO BUILDERS, CONTRACTORS, AND OTHERS.
CONTRACT No. 17.

THE Rawmarsh Local Board invite TENDERS from experienced Contractors for the Construction of a BRICK GASHOLDER TANK, 82 feet in diameter and 20 feet deep, at their Gas-Works, Parkgate, Rawmarsh.

The Specifications and Drawings may be seen at my Offices in Rawmarsh.

Copies of the Bill of Quantities and Forms of Tender may be obtained from me, the undersigned, on deposit of Two Guineas, which will be returned on receipt of a *bonâ fide* tender.

Sealed tenders, endorsed "Gas Tank," to be addressed to me, the undersigned, and sent so as to reach me not later than Twelve o'clock at Noon on Tuesday, the 31st day of May, 1892.

The Board do not bind themselves to accept the lowest or any tender.

By order,
J. W. BELLAMY,
Clerk to the Board.

Local Board Offices, Rawmarsh,
May, 1892.

RAWMARSH LOCAL BOARD GAS-WORKS.

TO GASHOLDER MAKERS.
CONTRACT No. 18.

THE Rawmarsh Local Board are pre- pared to receive TENDERS for the Construction and Erection of a GASHOLDER, at their Gas-Works, Parkgate, Rawmarsh.

The Drawings and Specifications may be seen at my Office in Rawmarsh.

Copies of the Bill of Quantities and Forms of Tender may be obtained from the undersigned on deposit of Two Guineas, which will be returned on receipt of a *bonâ fide* tender.

Sealed tenders, endorsed "Gasholder," to be addressed to me, and sent so as to reach me not later than Twelve o'clock at Noon on Tuesday, the 31st day of May, 1892.

The Board do not bind themselves to accept the lowest or any tender.

By order,
J. W. BELLAMY,
Clerk to the Board.

Local Board Offices, Rawmarsh,
May, 1892.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

GAS COAL.

THE Directors of the Dundalk Gas Company invite TENDERS, on or before the 1st of June, for the supply of from 1000 to 2000 tons of best GAS COAL.

Particulars may be obtained from

JOSEPH A. COULTER.
Secretary.

May 12, 1892.

TENDERS FOR THE SUPPLY OF GAS COAL.

THE Widnes Local Board invite Tenders for the supply of about 15,000 tons of GAS COAL (Slack "through and through," or Screened Coal), to be delivered at the Gas-Works, Widnes.

Conditions and Forms of Tender may be obtained from Mr. CARR, C.E., Gas Engineer, Widnes.

Tenders to be addressed to the Chairman of the Gas Committee, endorsed "Gas Coal," and delivered to the undersigned not later than Eleven a.m. on Monday, the 30th day of May.

The Board do not bind themselves to accept the lowest or any tender.

H. S. OPPENHEIM,
Clerk.

Town Hall, Widnes,
May 12, 1892.

LEEK IMPROVEMENT ACT, 1855.

TO TAR DISTILLERS AND OTHERS.

TENDERS are invited for the purchase of the surplus GAS TAR produced at the Leek Gas-Works, for One, Two, or Three years, from the 1st of July, 1892, at per ton of 2240 lbs. at such Works.

Endorsed tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, by Four o'clock in the Afternoon of Monday, the 23rd of May inst.

Forms of Tender and further Particulars may be obtained from the undersigned.

The highest or any tender will not necessarily be accepted.

By order of the Commissioners,
C. HENSHAW,
Clerk.

Town Hall, Leek,
May 7, 1892.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Leek Improvement Commissioners invite TENDERS for the supply of best screened GAS COAL and CANNEL, for One, Two, or Three years, from the 1st of July next, to be delivered at the Leek Station, on the North Staffordshire Railway, at such times and in such quantities as may be required.

Annual consumption about 4000 to 4500 tons of Coal, and 1000 tons of Cannel.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, by Four o'clock in the Afternoon of Monday, the 23rd of May inst.

The lowest or any tender will not necessarily be accepted.

By order,
C. HENSHAW,
Clerk.

Town Hall, Leek,
May 7, 1892.

BOROUGH OF ROTHERHAM.

ENGINE AND EXHAUSTER.

THE Gas Committee are prepared to receive TENDERS for the supply and erection of an ENGINE and EXHAUSTER, capable of passing 60,000 cubic feet of Gas per hour.

Particulars may be obtained upon application to the Gas Engineer, Mr. C. B. Newton.

Plan of Engine and Exhauster to accompany tender.

The Contractor whose tender may be accepted by the Corporation is required to pay his workmen (whether Artisans or Labourers) not less than the minimum standard rate of wages paid in Rotherham and district for the time being in each branch of trade, and to observe the recognized hours and proper conditions of labour.

Tenders to be sent in to me, on or before the 31st inst., endorsed "Exhauster."

By order,
H. H. HICKMOTT,
Town Clerk.

Council Hall, Rotherham,
May 13, 1892.

BOROUGH OF ROTHERHAM.

THE Gas Committee are prepared to receive TENDERS for the supply of RETORTS, FIRE-BRICKS, &c.

Specification and Form of Tender may be obtained upon application to the Gas Engineer, Mr. C. B. Newton.

The Contractor whose tender may be accepted by the Corporation is required to pay his workmen (whether Artisans or Labourers) not less than the minimum standard rate of wages paid in Rotherham and district for the time being in each branch of trade, and to observe the recognized hours and proper conditions of labour.

Tenders to be sent in to me, on or before the 31st inst., endorsed "Fire-Clay Goods."

By order,
H. H. HICKMOTT,
Town Clerk.

Council Hall, Rotherham,
May 13, 1892.

MESSRS. Wheatley and Mackenzie beg to say that they have acquired the business of the late W. H. BENNETT, Esq., and that having a special experience in matters connected with Gas, Water, and Sanitary Improvement, will continue to give the same assistance to Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, or LETTERS PATENT.

Patents completed or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to WHEATLEY AND MACKENZIE, 40, Chancery Lane, LONDON, W.C.

COUNTY BOROUGH OF BURNLEY.

(GAS DEPARTMENT.)

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for WROUGHT-IRON STAGE-FLOORS and COAL-HOPPERS in the No. 3 Retort-House at their Lane Bridge Gas-Works.

Specifications and Forms of Tender can be obtained, and the Drawings inspected, on application to Mr. Jno. P. Leather, at the Gas-Works.

Tenders, sealed, and endorsed "Tender for Ironwork," to be sent in, addressed to the Chairman of the Gas Committee, Town Clerk's Office, Town Hall, Burnley, on or before Wednesday, the 25th of May, 1892.

By order,
JNO. P. LEATHER,
Gas Engineer.

MANCHESTER CORPORATION GAS-WORKS.

SPENT OXIDE.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the Purchase and Removal of the SPENT OXIDE to be produced at their Gaythorn, Rochdale Road, and Bradford Road Works during a period of One, Two, or Three years from the 30th of June next.

The Committee do not bind themselves to accept the highest or any tender.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Spent Oxide," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 2nd day of June next.

Forms of Tender and further Particulars may be obtained on application in writing to Mr. Charles Nickson, Superintendent of the Gas Department.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, May 13, 1892.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 45,000 tons of best well-screened large GAS COAL, to be delivered between July, 1892, and June 30, 1893, in monthly quantities, in accordance with the Specification.

Parties tendering may do so for the whole quantity or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Thursday, the 2nd day of June next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
April 30, 1892.

SUTTON-IN-ASHFIELD LOCAL BOARD.

(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Sutton-in- Ashfield Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1 to Dec. 31, 1892.

Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price per ton of 20 cwt. at the Works, or at Sutton-in-Ashfield Railway Station, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Tar and Liquor," so as to arrive not later than Tuesday, the 31st day of May, 1892.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

SUTTON-IN-ASHFIELD LOCAL BOARD.

(GAS DEPARTMENT.)

SUPPLY OF GAS COAL.

THE Gas Committee of the above Local Board are prepared to receive TENDERS for the supply of 1400 tons of well-screened GAS COAL, to be free from Shale and Pyrites, and to be delivered at the Railway Station, Sutton, in such quantities as the Manager shall from time to time direct, between July 1 and Dec. 31, 1892.

Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price, to be addressed as above, and marked "Tender for Coal," so as to arrive not later than Tuesday, the 31st day of May, 1892.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.

HINCKLEY LOCAL BOARD.

(GAS DEPARTMENT.)

THE Gas Committee of the above Board invite TENDERS for the following:—

4000 tons of screened GAS COAL.
150 „ CANNEL COAL.
150 „ LIME.
35 „ SULPHURIC ACID.

Supply of CAST-IRON PIPES.

And for the disposal of their surplus COKE and TAR (about 1000 tons of the former, and 300 tons of the latter).

For further Particulars and Forms of Tender, apply to the undersigned, to whom sealed and endorsed tenders must be sent in on or before Saturday, June 4.

E. H. MILLARD,
Gas-Works Manager.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive TENDERS for the COAL and CANNEL required at their Works, during a period of One, Two, or Three years.

Forms of Tender and Conditions of Contract may be obtained on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered before Five p.m., on Thursday, the 26th inst.

By order,
SAML. BROWN,
Town Clerk.

Town Hall, Salford,
May 14, 1892.

STEAM-PUMPS.

THE Brighouse Local Board are pre- pared to receive DESIGNS and TENDERS for the supply of Three STEAM-PUMPS for Tar and Ammoniacal Liquor, delivered and fixed at their Gas-Works, Brighouse.

Particulars can be obtained on application to the undersigned.

Sealed tenders, addressed to Frederick Laxton, Esq., Chairman of the Local Board, Public Offices, Brighouse, are to be sent in on or before Tuesday, the 31st day of May, 1892, endorsed on the outside, "Tender for Steam-Pumps."

The Board do not bind themselves to accept the lowest or any tender.

By order,
JAMES PARKINSON,
Engineer.

Public Offices, Brighouse,
May 14, 1892.

THE Goole and District Gas and Water Company are prepared to receive TENDERS for the supply of from 3500 to 4000 tons of best screened GAS COAL during a period of Twelve months from July 1 next.

Tenders to state price per ton of 21 cwt., delivered alongside the Aire and Calder Navigation Basin, or at the Bridge Street Siding of the Lancashire and Yorkshire Railway Company, Goole.

Particulars of Contract can be obtained at the Company's Office, Goole.

Sealed tenders, endorsed "Gas Coal," to be delivered to the undersigned on or before Saturday, May 28.

The Directors do not bind themselves to accept the lowest or any tender, but reserve to themselves the right to divide the contract.

W. OLDFIELD,
Manager.

Gas Office, Goole,
May 14, 1892.

TO TAR DISTILLERS, MANUFACTURING CHEMISTS, AND OTHERS.

THE Directors of the Rochester, Chat- ham, and Strood Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works at Rochester and Gillingham for One year, commencing the 1st of July next.

In 1891, the quantity of Tar was about 300,000 gallons; of Liquor, about 800,000 gallons.

Further particulars may be had on application at the Office of the Company, 58, High Street, Rochester.

Tenders may be for Tar or Liquor separately or together, and are to be delivered at the Office, marked "Tender for Tar" or "Liquor," not later than Noon of Thursday, the 19th of May.

The Directors do not bind themselves to accept the highest or any tender; and security for due fulfilment of the contract must be given if required.

WILLIAM SYMS,
Secretary and Manager.

Gas Office, 58, High Street, Rochester,
May 1892.

LURGAN GAS, LIGHT, AND CHEMICAL COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors are anxious to procure TENDERS for the supply of 2500 tons of best screened GAS COAL, delivered into Lighters *ex* Ship, at Belfast, free of all charges.

Delivery of 2000 tons will be taken before the 1st of November next; the remainder to be delivered at such times before the 1st of March, 1893, as may be required.

Vessels carrying from 200 to 300 tons can at once deliver into Lighters; and these Lighters be back for a further Cargo within a period to be arranged.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Ten o'clock in the Forenoon of Monday, the 6th of June next.

The Directors do not bind themselves to accept the lowest or any tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
May, 1892.

FENTON URBAN SANITARY DISTRICT.
(Gas Department.)

THE Gas Committee invite Tenders for the supply and delivery of 3000 tons of good GAS COAL or BURGY.

Forms of Tender and Particulars may be obtained from the Manager.

Tenders to be sent in, on or before Tuesday, the 24th day of May next, marked "Tender for Coal," addressed to the Chairman, Gas-Works, Fenton.

F. H. Darwin,
Manager.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works for One or more years from the 1st day of July next.

Sealed tenders, addressed to James Warburton, Esq., Chairman, to be delivered at the Gas Offices on or before Monday, the 23rd of May.

Any further particulars required may be obtained on application to Mr. T. L. Sheppard, Manager.

TENDERS FOR COAL.

THE Directors of the Derby Gaslight and Coke Company are prepared to receive TENDERS for the supply of 40,000 tons of COAL or NUTS.

Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Finance Committee, must be delivered at the Offices of the Company, Friar Gate, on or before Tuesday, the 24th day of May.

Richard Fisher,
Secretary.

May 7, 1892.

BOROUGH OF NELSON.
(Gas Department.)

THE Gas Committee of the above Corporation invite TENDERS for the supply of about 14,000 tons of good screened GAS COAL for a period of Twelve months.

Form of Tender and all further Information can be obtained from Mr. Wm. Foster Gas Manager, Nelson.

Tenders, endorsed "Tender for Coal," must be sent to the undersigned, on or before the 23rd day of May, 1892.

R. M. Prescott,
Town Clerk.

Town Hall, Nelson,
April 28, 1892.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 20,000 tons of CANNEL, best well-screened GAS COAL, and NUTS, to be delivered between the 1st of July, 1892, and the 30th of June, 1893.

Forms of Tender and Specification may be obtained on application to the undersigned.

Sealed tenders to be sent to the Chairman of the Company, not later than the 1st day of June next, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

By order,
W. Duesbury, Manager.

Gas-Works, Cambridge,
May 7, 1892.

ACCRINGTON GAS AND WATER WORKS COMPANY.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Directors invite Tenders for the purchase of the TAR and AMMONIACAL LIQUOR which may be produced at their Accrington and Great Harwood Works during a period of One year, commencing on the 1st of July next.

The quantity will be about 1300 tons of Tar and 3000 tons of Liquor (10-oz.).

Tenders, addressed to the Chairman, Offices of the Company, St. James's Street, Accrington, must be in my hands not later than Wednesday, the 8th of June.

By order,
Chas. Harrison,
Secretary and Manager.

CITY OF BIRMINGHAM.

TENDERS FOR AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the purchase of the AMMONIACAL LIQUOR produced at their Works during a period of Ten years, beginning on July 1, 1893.

The quantity produced in the year ended March 31, 1891, was 13,683,000 gallons of 10-oz. Liquor.

Provision may be made for dealing with the Liquor either in Works now erected on Land belonging to the Corporation, or on Land to be let for the erection of new Works.

Copies of the conditions on which tenders are invited may be obtained on application to

Edwin Smith,
Secretary.

City Gas Offices, Council House,
Birmingham.

EIGHTH EDITION, REVISED AND ENLARGED.

Just published, Fcap. 8vo, 5s. 6d. Cloth Limp, or 6s. Cloth Boards.

GAS-WORKS: Their Construction and Arrangement, and the Manufacture and Distribution of Coal Gas. By S. HUGHES. Eighth Edition. Revised, with Notices of Recent Improvements. By WM. RICHARDS, C.E.

London: Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C.

GODSTONE DISTRICT GAS COMPANY, LIMITED.

THE Directors invite Applications for 757 £5 SHARES, the unissued Capital of the Company.

The Company's Works at Lingfield, Surrey, were opened in February, 1891; the consumption of gas has increased each quarter, and will continue to do so. The Works at Godstone are now being erected; and the Directors intend to have them opened for the supply of Gas in September next, when the whole of the Capital will be earning revenue.

Prospectuses, with Form of Application, can be obtained from the Secretary, at the Office of the Company, 9, London Street, Fenchurch Street, E.C.

SALE OF GAS SHARES IN THE

Southend Gas Company, £320 Original 10 per cent. Stock.
Harrow District Gas Company, 16 Shares.
Brighton and Hove General Gas Company, 16 Original £20 Shares.
West Ham Gas Company, £1200 perpetual 4 per cent. Debenture Stock.
West Ham Gas Company, 111 Original £5 Shares.
Romford Gas and Coke Company, Limited, 35 Original £5 Shares.

MR. ALFRED RICHARDS will sell the above BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Friday, May 20, at Twelve for One precisely, in lots.

Particulars of the Auctioneer, 18, Finsbury Circus, E.C.

MONTE VIDEO GAS COMPANY, LIMITED.

NOTICE is hereby given that the Twentieth ORDINARY GENERAL MEETING of the Company will be held at the Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 31st day of May, 1892, at Twelve o'clock Noon, to transact the General Business of the Company.

The Transfer Books will be closed from the 18th to the 31st of May inclusive.

By order,
A. G. Hounsham,
Secretary.

Offices of the Company: Suffolk House,
Laurence Pountney Hill, E.C., May 17, 1892.

BAHIA GAS COMPANY, LIMITED.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Company's Offices, 9, Queen Street Place, Cannon Street, London, E.C., on Thursday, the 19th day of May, 1892, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for General Purposes.

The Chair will be taken at Three o'clock precisely.

By order of the Board,
Thomas Guyatt,
Secretary.

May 5, 1892.

The Transfer Books are closed from the 5th to the 19th inst., inclusive.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is hereby given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 7th of June, 1892, at Twelve o'clock at Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1892, and for the transaction of the General Business of the Company.

One of the Directors, Colonel James Le Geyt Daniell, will retire from office, but offers himself for re-election.

The Auditors, Robert Hesketh Jones and Thomas Guyat, Esqs., will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 24th of May until the day of the meeting, both days inclusive.

By order,
A. W. Cooper,
Secretary.

60, Gracechurch Street, E.C.,
May 10, 1892.

Price 2s. per dozen, or 10s 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of Walter King, 11, Bolt Court, Fleet Street, E.C.

*** *The Act extends to Scotland and Ireland.*

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

MARKS & RUSSELL,
Cannel and Gas Coal Merchants,
53, WATERLOO STREET,
GLASGOW.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production nearly 3000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves 69 per cent. of excellent Coke. During the year 1890, the London Gas Companies carbonized about 400,000 tons of HOLMSIDE COALS. They are used by The Gaslight and Coke Company, the South Metropolitan Gas Company, the Commercial Gas Company, the Woolwich (Government) Gas-Works, the Newcastle and Gateshead Gas Company, the European Gas Company, the Ipswich Gas Company, and by many other Gas Companies both at Home and Abroad.

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

Lanemark Coal Co.,
LIMITED.

LANEMARK CANNEL AND GAS COALS.

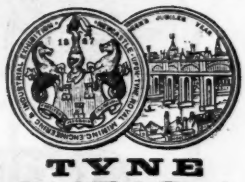
Quotations and Analysis on application to

LANEMARK COLLIERY,
NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.



TYNE
BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·86 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

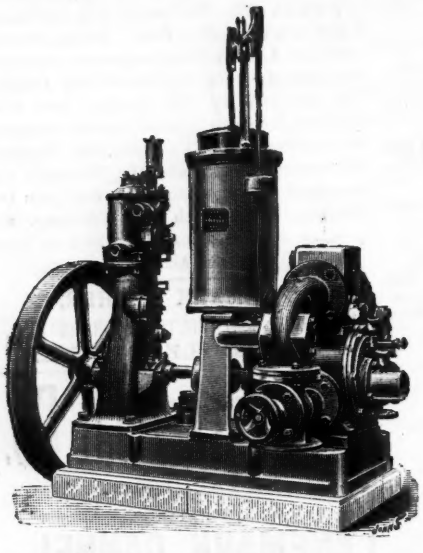
For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.,
Coal Owners, Newcastle-on-Tyne.
Or E. FOSTER & CO., 21, John St., Adelphi, LONDON, W.C.

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.
TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
MIRFIELD, NORMANTON.

CAST-IRON PIPES
FOR GAS AND WATER.
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.
VALVES
FOR GAS, WATER, AND STEAM
TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.



WALLER'S PATENT COMBINED GAS ENGINE AND EXHAUSTER
WITH
Disc-Valves, Automatic Bye-Pass Valve, Throttle-Valve, and Regulator,
COMPLETE ON ONE BASE PLATE.
Designed chiefly for sizes from 500 to 15,000 feet per hour.
EXHAUSTERS OF ANY SIZE
COMBINED WITH GAS-ENGINES (now made to vary in speed).
ENGINES & EXHAUSTERS RUN AT DIFFERENT SPEEDS
Waller's Washer-Scrubber with Wood Clusters.
ELEVATING AND CONVEYING MACHINERY FOR COAL, COKE, &c.
ILLUSTRATED CATALOGUE ON APPLICATION.
G. WALLER & Co., Engineers, Founders, Boiler Makers,
58, PARK STREET, SOUTHWARK; & STROUD, GLOUCESTERSHIRE.

ROBT. DEMPSTER & SONS,
LIMITED.

PURIFIERS.
ELLAND.
Purifiers with planed joints and lutes cast with plates.
Having put down special machinery for moulding and planing plates, we are in a position to execute orders, with the utmost despatch, in a very superior manner.

GASHOLDERS

C. & W. WALKER

Have erected Gasholders of all dimensions, during the last 40 years, in all parts of Great Britain, and throughout the civilized world, for upwards of 500 Gas Companies and Municipalities; all of the best materials and highest class of workmanship.

They are now erecting a four-lift Holder of about 8 MILLION cubic feet, at the Beckton Gas-Works, London.

MIDLAND WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

AND

10, Finsbury Square, London, E.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

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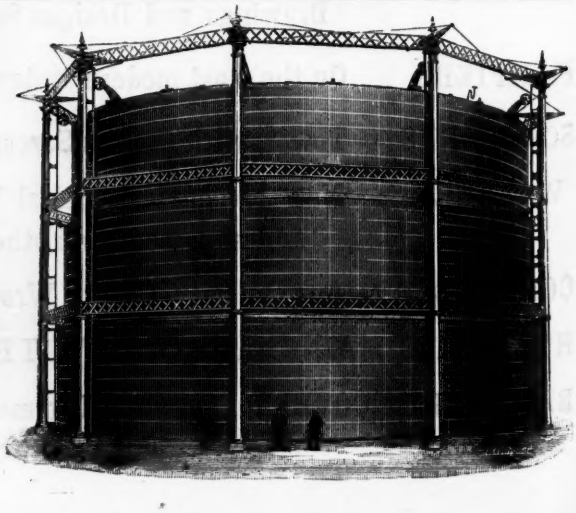

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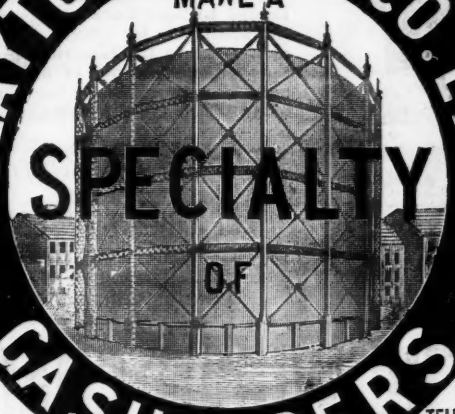

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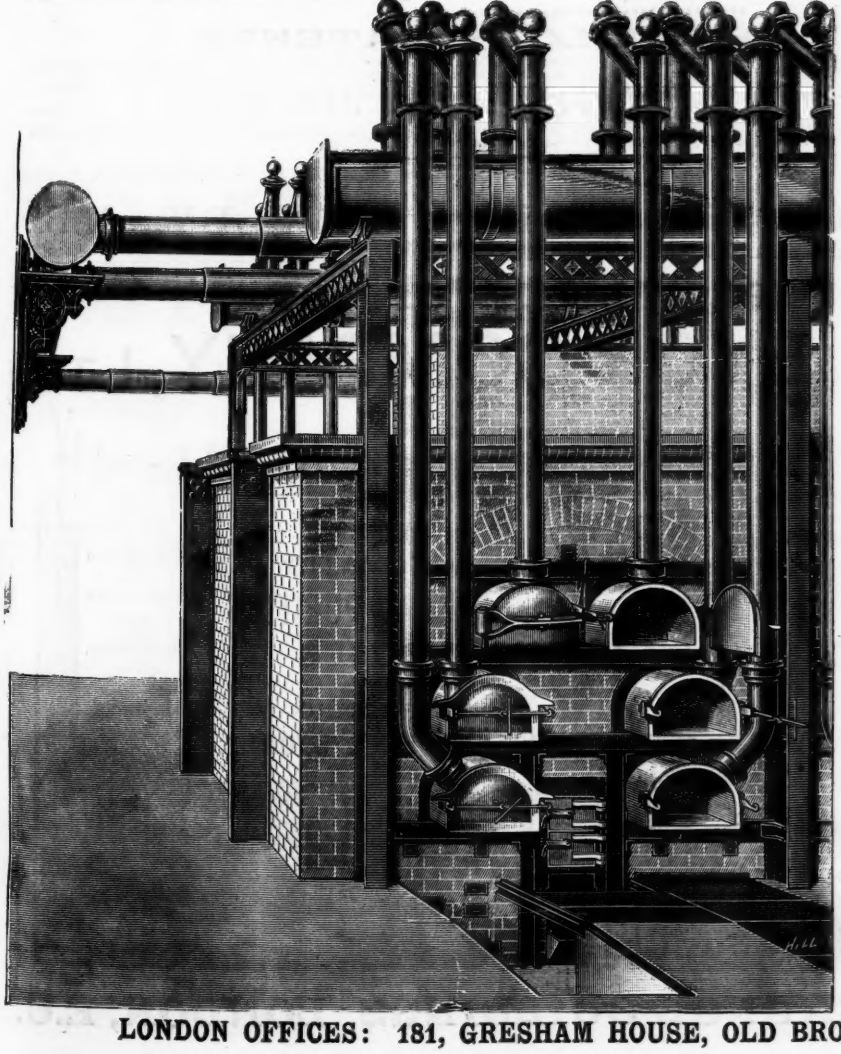

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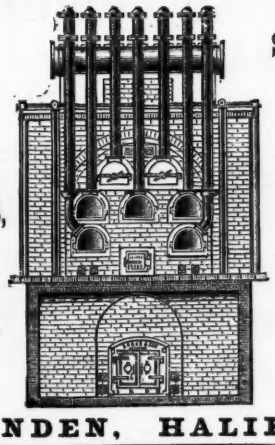

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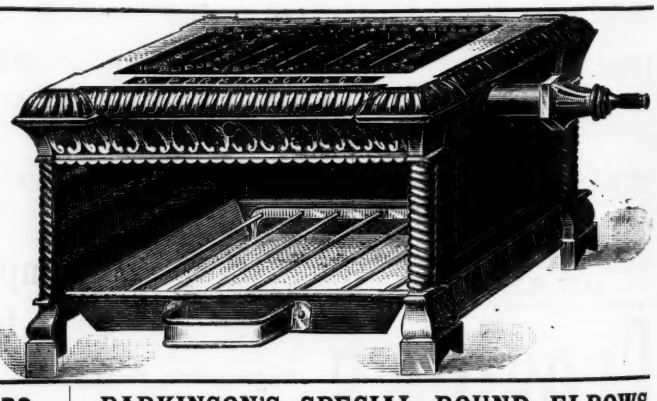

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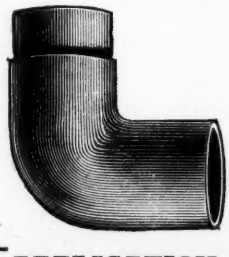

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